Express Mail No. EV417055295 US

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : A61G 7/05, A61M 5/14

A1

(11) International Publication Number: WO 00/09061

(43) International Publication Date: 24 February 2000 (24.02.00)

(21) International Application Number: PCT/US99/18405

(22) International Filing Date: 12 August 1999 (12.08.99)

(30) Priority Data:
60/096,610 14 August 1998 (14.08.98) US

(71) Applicant: THE GENERAL HOSPITAL CORPORATION doing business as MASSACHUSSETS GENERAL HOSPITAL [US/US]; 55 Fruit Street, Boston, MA 02114 (US).

(72) Inventors: SIMS, Nathaniel, M.; 378 Canton Avenue, Milton, MA 02186 (US). WRIGHT, John, D.; 54 Hawkewood Road, Sandown, NH 03873 (US). RIBEIRO, Robert; 197 Willis Avenue, Medford, MA 02155 (US). GEORGE, Arnold, J.; 893 East Fourth Street, South Boston, MA 02127 (US). WOLLOWITZ, Michael, H.; 15 Elm Street, Chatham, NY 12037 (US). SPROUL, Richard, J.; 403 Colombian Street, South Weymouth, MA 02190 (US).

(74) Agents: DURKEE, Paul, D. et al.; Nutter, McClennen & Fish, LLP, One International Place, Boston, MA 02110-2699 (US).

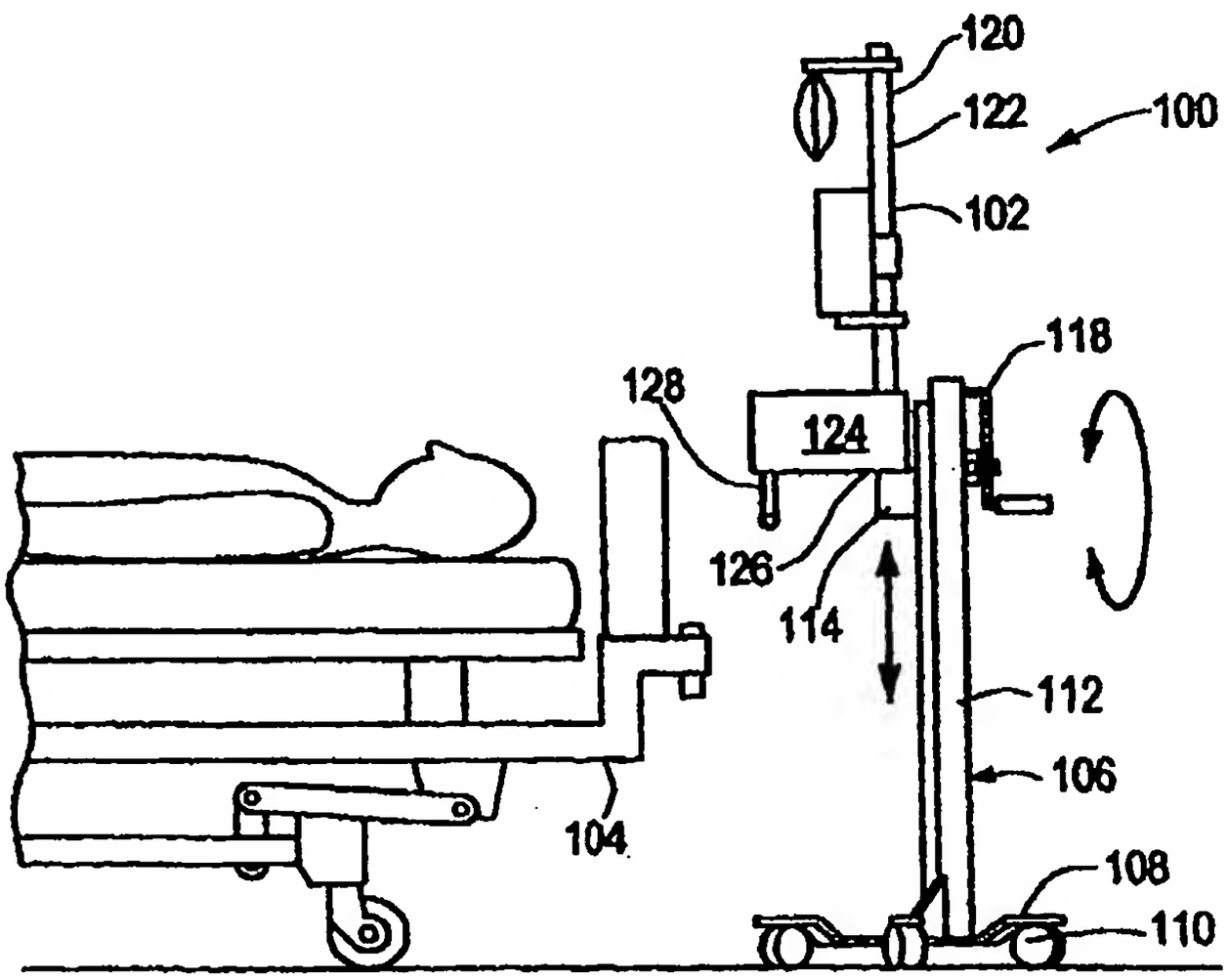
(81) Designated States: CA, JP, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: TRANSFER SYSTEM FOR PORTABLE PATIENT CARE APPARATUS

(57) Abstract

A portable patient care device transfer system includes an equipment support element that can be rapidly and safely transferred between a mobile base element and the patient's bed. In one embodiment, the base element includes a rack coupling mechanism movably secured to a vertical structural member. The equipment support element includes a rack supported by a support member extending from a housing, which includes a bed coupling mechanism and a base coupling mechanism located on the housing bottom. The bed coupling mechanism is engageable to the bed and the base coupling mechanism is engageable to the rack coupling mechanism of the base element. To transfer the equipment support element from the bed to the base element, the rack coupling mechanism on the base element is lowered and aligned with the base coupling mechanism of the housing. The rack coupling mechanism is then raised to lift the equipment support element until it is disengaged from the bed and supported by the base element, which can then be moved away from the bed. The process is reversed to transfer the equipment support element back to the bed.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

TRANSFER SYSTEM FOR PORTABLE PATIENT CARE APPARATUS

FIELD OF THE INVENTION

The present invention relates generally to medical devices, and more particularly, to devices for transferring patient care apparatus between a hospital bed and a mobile stand.

BACKGROUND OF THE INVENTION

Within the hospital environment, there is a need to care for patients in fixed locations, such as a hospital room, and also to transport patients and equipment safely from one area to another. Typically this involves movement between a ward, such as an intensive-care ward, and a surgical, radiological, or other care area. Such movement of patients frequently involves surface-to-surface transfers where the patient's body must be rapidly moved from the hospital bed to an operating room table, for example, or the table of a medical imaging device, such as a CT scanner.

If the patient is critically-ill, it is typical to carry out the transport using the patient's hospital bed as the transport vehicle, rather than using a stretcher or gurney. Indeed, standard hospital beds, which are relatively large, are mounted on wheels and are designed to be moved by one or two staff persons. Commonly used hospital beds include the "Centra" and "Total Care" beds manufactured by Hill-Rom and others. FIGS. 1A-C show a conventional hospital bed 2 having a lower frame 3, an intermediate frame 4, and an upper frame 5. It is typical for the patient to be transported with the intermediate frame 4 of the bed in a horizontal position. The bed 2 can be manipulated between lowered (FIG. 1B) and raised (FIG. 1C) positions.

As shown in FIG. 2, movement of the critically-ill patient 10 is made more complex because the patient is often connected by one or more tubes or cables 12 to a substantial assembly of portable patient care devices (PPCD) 14, including IV drips and infusion pumps. If the PPCD assembly 14 is located on, for example, an adjacent shelf, the components must be moved to a position on the bed, or on a wheeled stand, prior to transport. If the PPCD assembly 14 is on a wheeled stand 16, the stand must be brought

along with the bed during transport, often requiring an additional person to assist and to prevent the connecting tubes and cables from being strained. In addition, the pole should be prevented from becoming caught or tipped-over on furniture, doorways, or elevator thresholds. If the PPCD assembly has been mounted directly on the bed, the components will need to be re-deployed to new locations at the end of the patient transport journey, particularly if surface-to-surface patient transfer is involved and the bed is to be removed from proximity to the patient for the duration of the procedure.

Some known devices attempt to overcome the above-described problems by co-movement or docking of a wheeled stand together with a hospital bed, similar to the well-known arrangement of a vehicle towing a trailer. While such devices may reduce the requirement for extra transport personnel, towing arrangements involving a wheeled-stand generally result in a travel footprint that is significantly larger than that of the bed alone. Such devices can, therefore, present a substantial problem during patient transport involving elevators, which typically provide limited space.

FIG. 3 shows one such towing-type system 20 known as the Pump Porter which comprises a coupling device having a short length of strong roller chain with a clamping element at each end. The chain is enclosed by a light coil spring and an outer flexible plastic tube. One clamp element is adapted for attachment to the frame of a stretcher or gurney and another clamp element is adapted for attachment to the column of a wheeled stand. The chain is oriented so that it can bend from side to side to allow repositioning of the pole, for example, to move the pole adjacent to the gurney in an elevator. The chain resists bending vertically or twisting to prevent the pole from tipping. This arrangement may be adequate for use with lightweight PPCAs and narrow stretchers. However, the Pump Porter will likely be overwhelmed by a combination of wide hospital beds, a heavy PPCD assembly and narrow elevators. See also U.S. Patent Nos. 5,118,127 to Partington, 5,699,988 to Boettget, and 5,337,992 to Pryor.

FIG. 4 shows another such system 30, known as the Omni-Pal system made by Pryor, including multiple vertical poles mounted on an oversized base. The system can be equipped with attachment pins that mate with existing sockets on the head end of the intermediate frame of a hospital bed. To achieve stability during transport, extra wheels on the base of the system must be swung out, which increases the overall length and footprint of the bed and pole combination. This system can not easily accommodate height or tilt adjustments of the bed. See also U.S. Patent No. 5,344,169 to Pryor et al. A similar system has been described in U.S. Patent No. 5,556,065 to Wadley.

A further system, the MobilEquip system made by Hill-Rom, includes a cart with attached vertical poles for mounting the PPCDs. It has a linking arm that connects to the lower bed frame near one of the casters. This system is much larger than an ordinary wheeled stand and significantly adds to the size, or travel footprint of the bed during transport. See U.S. Patent Nos. 5,513,406 to Foster, 5,117,521 to Foster, and 5,898,961 to Ambach.

Another family of devices that attempt to overcome some of the above-described disadvantages is directed to equipment racks or supports for a plurality of portable patient care devices. Such devices mount the racks either on a patient bed or on a selected locus, such as a ceiling or wall-mounted bracket, or on a wheeled stand. In some of these devices, the bed mounting location of the rack is for use in transport only. In other devices, the bed mounting location of the rack is adapted for use both during transport, and optionally, during patient care.

FIGS. 5A-B show a rack transfer mechanism 40 teaching the use of a telescoping, ceiling-mounted column as a mounting point for an equipment rack. The powered column also provides a means for transferring the rack to a mounting location on a hospital bed for patient transport. However, the bed location of the equipment rack is primarily for use only during transport since access to the patient is severely restricted by the lateral bed mounting position of the rack. See U.S. Pat. No. 4,795,122 to Petre.

FIGS. 6A-C show another such system 50 developed at Massachusetts General Hospital in Boston, Massachusetts, which employs an equipment rack and couplings which allow the rack to cooperate with both a wheeled base and a hospital bed. See U.S. Patent No. 4,945,592 to Sims et al. A lower section includes a wheeled base and upright column and a detachable upper section has a rack for attaching fluid bags, patient care devices, and the like. The system includes first and second horizontal flanges, and pin and socket mating means, so that the rack can be mounted either on the wheeled base or on the head end of the intermediate frame of the bed. The system is usable with the so-called Centra and Total-Care beds, and motorized vertical movement of the bed is used to transfer the rack between the two mounting locations. For transport (or optionally, during care of the patient), the rack is mounted on the bed. During patient care and with the rack mounted on the bed, the second horizontal flange and rack are movable in dual pivotal engagement allowing substantial care-giver access to the equipment and to the patient. Additional wheeled bases are kept in wards and clinical care areas so that the rack can be deployed from the bed to the wheeled base in various locations as required. The rack can include a power outlet to provide a source of energy for the equipment. See U.S. Patent No. 5,647,491 to Foster et al.

FIGS 7A-C show a system 60 similar to that shown in FIGS. 6A-C having the rack mounted on the bed in dual pivotal engagement.

FIGS. 8A-B show a further system 70 for transferring an equipment rack between a wheeled stand and a hospital bed. The system 70 includes a wheeled stand of fixed height and an equipment rack similar to those described in Sims and Petre. The rack is transferable to a bracket mounted on a hospital bed in a generally horizontal, slidable fashion. Disadvantages of the system include a requirement to pre-adjust the bed height to a high degree of precision prior to performing the horizontal transfer and the potential for the rack to become unstable and to fall under conditions of operator error (misalignment of the members, etc.) In a fashion similar to Petre, the bed location of the equipment rack is

primarily for use only during transport since patient access is severely restricted by the lateral bed mounting position of the rack. See U.S. Patent No.5,319,816 to Ruehl.

Further, some known PPCD transport devices are a possible source of injury, particularly to patient caregivers, due to the large amount of weight that may be mounted on the rack. Back injuries, in particular, might result from attempts to lift PPCDs from a wheeled base or other site, to a bed or bed socket, or vice-versa, for transfer purposes, without adequate mechanical aid.

It would be desirable, therefore, to provide a system for rapidly and safely transferring portable patient care devices between a hospital bed and a mobile base.

SUMMARY OF THE INVENTION

The present invention provides a system for transferring equipment from one location to another. Although the invention is generally shown and described as a system for transferring portable patient care devices between a hospital bed and a mobile base element, it is understood that the invention has other applications as well.

In an exemplary embodiment, a portable patient care device transfer system includes a base element having a vertical structural member extending from a wheeled platform. A rack coupling mechanism is movably secured to the structural member. In one embodiment, the rack coupling mechanism includes a socket or vertical pin that is offset from the structural member. An actuator mechanism, such as a motor or a crank, is connected to the structural member for vertically positioning, e.g., raising and lowering, the rack coupling mechanism on the structural member.

The system further includes an equipment holder element that is selectively engageable to the base element and to a patient's bed. The equipment holder element includes a rack secured to an upper end of a support member extending from a housing. The housing includes a base coupling mechanism for engaging the rack coupling mechanism of the base element and a bed coupling mechanism for engaging a patient's hospital bed. In one embodiment, the base coupling mechanism includes a downwardly extending pin for

engaging the socket in the rack coupling mechanism of the base element. The bed coupling can include a downwardly extending pin that is engageable with a corresponding socket in the bed frame. The two downwardly extending pins may have distinct geometries to ensure that the pins are coupled to corresponding socket.

To transfer the equipment holder element from the bed to the base element, the actuator on the base element is activated to lower the rack coupling mechanism, which can include a socket, to a height less than the bottom of the pin extending from the bottom of the housing. The base element is manipulated until the socket is aligned with the corresponding pin extending from the housing. The actuator then raises the socket with respect to the structural member such that the socket receives the pin. The rack coupling mechanism is raised until the equipment holder element is fully disengaged from the bed, i.e., the bed coupling pin of the housing exits the socket in the bed frame. The mobile base element, which now supports the equipment holder, can be moved away from the bed. The process is reversed to transfer the equipment holder from the base element to the bed.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more fully understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1A is a pictorial representation of a prior art hospital bed;

FIG. 1B is a pictorial representation of the prior art hospital bed of FIG. 1A shown in a lowered position;

FIG. 1C is a pictorial representation of the prior art hospital bed of FIG. 1A shown in a raised position;

FIG. 2 is a pictorial representation of a prior art wheeled IV stand shown supporting a portable patient care device connected to a patient;

FIG. 3 is a pictorial representation of a prior art mechanism for coupling a wheeled IV stand to a hospital bed;

FIG. 4 is a pictorial representation of a prior art wheeled rack for coupling to a hospital bed;

FIG. 5A is a pictorial representation of a prior art system including a telescoping column mounted to a ceiling for supporting an equipment rack;

FIG. 5B is a pictorial representation of the prior art system of FIG. 5A showing the rack mounted to a hospital bed;

FIG. 6A is a pictorial representation of a prior art system including a vertically adjustable hospital bed and a wheeled stand;

FIG. 6B is a pictorial representation of the prior art system of FIG. 6A showing the bed in a lowered position;

FIG. 6C is a pictorial representation of the prior art system of FIG. 6A showing the bed in a raised position;

FIG. 7A is a pictorial representation of a prior art system including a rack pivotally mounted to a hospital bed shown in a first position;

FIG. 7B is a pictorial representation of the prior art system of FIG. 7A showing the rack in a second position;

FIG. 7C is a pictorial representation of the prior art system of FIG. 7A showing the rack in a third position;

FIG. 8A is a pictorial representation of a prior art system including a rack mounted on a wheeled stand;

FIG. 8B is a pictorial representation of the prior art system of FIG. 8A showing the rack slidably mounted to a hospital bed;

FIG. 9 is a pictorial representation of a portable patient care apparatus transfer system in accordance with the present invention;

FIG. 10 is a more detailed view of coupling mechanisms that form a part of the system of FIG. 9;

FIG. 11 is a detailed view of an alternative embodiment of the coupling mechanisms of FIG. 10;

FIG. 12 is a detailed view of a further alternative embodiment of the coupling mechanisms of FIG. 10;

FIG. 12A is a partly cross-sectional view of an exemplary embodiment of a pin and socket coupling in accordance with the present invention that forms a part of the transfer system of FIG. 9;

FIG. 13 is a schematic view of an exemplary mechanical actuator that can form a part of the system of FIG. 9, wherein the actuator is shown in a first position;

FIG. 14 is a schematic view of the actuator of FIG. 13 shown in a second position;

FIG. 15A is a pictorial representation of a portable patient care apparatus transfer system in accordance with the present invention having a motorized actuator;

FIG. 15B is a front view of a portable patient care apparatus transfer system in accordance with the present invention having a motorized actuator;

FIG. 15C is a perspective view of a portable patient care apparatus transfer system in accordance with the present invention;

FIG. 16A is a front view of a rack that forms a part of the system of FIG. 9;

FIG. 16B is a side view of the rack of FIG. 16A;

FIG. 17A is a pictorial representation of the portable patient care apparatus transfer system of FIG. 13 shown supporting a rack;

FIG. 17B is a pictorial representation of the portable patient care apparatus transfer system of FIG. 13 shown in a raised position;

FIG. 17C is a pictorial representation of the portable patient care apparatus transfer system of FIG. 13 shown in a transfer position;

FIG. 17D is a pictorial representation of the portable patient care apparatus transfer system of FIG. 13 shown in a lowered position;

FIG. 17E is a pictorial representation of the portable patient care apparatus transfer system of FIG. 13 shown in a disengaged position;

FIG. 18A is a pictorial representation of the portable patient care apparatus transfer system of FIG. 13 shown in the disengaged position;

FIG. 18B is a pictorial representation of the portable patient care apparatus transfer system of FIG. 13 shown in a lowered position;

FIG. 18C is a pictorial representation of the portable patient care apparatus transfer system of FIG. 13 shown in a lowered position proximate the rack;

FIG. 18D is a pictorial representation of the portable patient care apparatus transfer system of FIG. 13 shown in a transfer position;

FIG. 18E is a pictorial representation of the portable patient care apparatus transfer system of FIG. 13 shown in a raised position supporting the rack;

FIG. 19A is schematic diagram of a lock mechanism, which can form a part of the system of FIG. 9, shown in a first position;

FIG. 19B is a schematic diagram of the lock mechanism of FIG. 18A shown in a second position;

FIG. 20 is a pictorial representation of a portable patient care apparatus transfer system in accordance with the present invention including a level detection mechanism;

FIG. 21 is a front view of a portable patient care apparatus transfer system in accordance with the present invention including a power distribution box; and

FIG. 22 is a front view of a portable patient care apparatus transfer system in accordance with the present invention including a data communication device.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a system for rapidly and safely transferring portable patient care devices (PPCDs), which are secured on a rack of an equipment holder element, between a hospital bed and a mobile base element. It is understood that PPCDs include a wide variety of equipment for coupling to or monitoring of a patient, such as IV drips, infusion pumps, and electronic monitoring devices. Such devices often must remain within a few feet of the patient at all times. A rack and its supported PPCDs can easily weigh more than a hundred pounds, with the individual devices weighing between about one and twenty pounds each. For example, a typical assemblage of PPCDs mounted on a rack, weighing

about 75 pounds, includes a 12 pound rack weight, three or more 12 pound infusion pumps, six or more 2 pound infusion pumps, and a variety of drip bags of medical fluids.

FIG. 9 shows a portable patient care device transfer system 100 in accordance with the present invention. The system 100 selectively transfers an equipment holder element 102 for holding PPCDs between a hospital bed 104 and a mobile base element 106. In FIG. 9, the equipment holder element 102 is shown supported by the base element 106.

The base element 106 includes a platform 108 having a series of wheels 110 coupled to a bottom of the platform for allowing an operator to position the base element in a desired location. A generally vertical structural member 112 extends upwardly from the platform 108. A rack coupling mechanism 114, which includes a vertically aligned rack coupling element 116 (FIG. 10), is movably secured to the structural member 112. The position of the rack coupling mechanism 114 on the structural member 112 is controlled by an actuator 118 secured to the structural member.

The equipment holder 102 includes a rack 120 extending from a generally vertical rack support member 122. A housing 124 is affixed to a lower end of the rack support member 122 for selectively engaging the base element 106 and the bed 104. The housing 124 includes a base coupling element 126 for securing the equipment holder 102 to the mobile base element 106 and a bed coupling element 128 for securing the equipment holder to the hospital bed 104. In one embodiment, the rack 120 is selectively rotatable about the support member 122 and/or the support member is rotatable with respect to the housing. In another embodiment, the vertical position of the rack 120 on the support member is adjustable.

It is understood that the coupling elements described herein can include a variety of structures providing the requisite mechanical strength and ease of use. Suitable mechanisms for the coupling elements include complementary pin and socket structures. It is understood, however, that other mating structures will be apparent to one of ordinary skill in the art.

FIG. 10 shows an exemplary embodiment of the system coupling mechanisms. In one embodiment, the rack coupling element 116 of the base element includes an upwardly extending pin 130 that is capturable in a corresponding base socket 132 formed in a bottom 134 of the housing 124. In one embodiment, the base socket 132 is generally aligned with a longitudinal axis 136 of the rack support member 122. It is understood, however, that the base socket 132 can be located in other locations in the housing 124 to balance the weight of the PPCDs with respect to the bed and/or the base element for optimal stability of the system.

The bed coupling element 128 (FIG. 9) of the housing 124 can include a pin 138 extending downwardly from the bottom 134 of the housing for mating with a corresponding socket 140 formed in a frame member 142 of the bed 104. In one embodiment, the bed pin 138 and socket 140 are offset from the longitudinal axis 136 of the rack support member.

It is understood that the coupling element 140 on the hospital bed 104 can be located in a variety of suitable locations on the bed frame. In addition, the coupling element, e.g., the socket 140, may be formed in the bed frame 142, or the socket may form a part of a separate element that is securable to the bed. The coupling element 140 should support a fully loaded rack without significantly increasing the footprint of the bed/rack assembly. In one embodiment, the coupling element includes a socket 140 in an intermediate frame portion 142 of the bed for receiving the bed coupling pin 138, which extends from the bottom of the housing 124.

FIGS. 11 and 12 show alternate pin/socket configurations for the system coupling elements. In FIG. 11, the base pin receiving socket 132 is formed within the housing 124. In FIG. 12, a pin 144 extends from the bottom of the housing 124 for insertion into a corresponding socket 146 of the rack coupling mechanism 114. In one embodiment, the base pin 144 and the bed pin 138, which extend from the bottom of the housing 124, have different sizes or have keyed surface features to ensure the pins are coupled to the correct sockets. Embodiments having downwardly extending pins may enhance an operator's ability to monitor proper engagement between corresponding pin/socket couplings.

FIG. 12A shows an exemplary pin 144 and socket 146 embodiment in accordance with the present invention. The pin 144 has an elongate body 147 with a tapered base 149 and a bulbous head 151. The bulbous head 151 facilitates insertion of the pin 144 into the socket 146 within a few degrees of vertical and the tapered base 149 maintains a vertical orientation for the pin, as well as the supported rack.

In an exemplary embodiment, the rack coupling mechanism 114 prevents rotation of the rack 120 with respect to the structural member 112. Alternatively, the rack coupling mechanism 114 allows selective rotation of the rack 120 to facilitate positioning of the patient care devices in relation to the patient.

The actuator 118 can comprise a variety of mechanisms that are effective to selectively move the rack coupling mechanism 114 on the structural member 112. Exemplary mechanisms include AC and DC motors, cranks, pumps and other manual and electrically powered devices.

FIGS. 13-14 show an exemplary mechanical actuator 200 for selectively raising and lowering the rack coupling mechanism 114 on the structural member 112. In an exemplary embodiment, the actuator 200 is generally housed within the structural member 112 and activated by means of a crank handle 202. The actuator 200 includes a first sprocket 204 coupled to the crank handle 202 and a second sprocket 206 located in a bottom of the structural member 112. A chain 208, which includes a slider 210, is engaged on the sprockets 204,206 such that rotation of the crank handle 202 moves the chain. The slider 210 is adapted for coupling to the rack coupling mechanism 114. A first idler 212 is disposed in the top of the structural member 112 proximate the first sprocket 204 and a second idler 214 is disposed in the bottom of the structural member. An upper cable 216 is coupled to the first idler 212 and to the slider 210 and a lower cable 218 is coupled to the second idler 214 and to the slider 210.

A damper 220 is vertically disposed in the structural member 112 to prevent the rack coupling mechanism 114, and any supported PPCDs, from rapidly falling from the raised position. The damper 220 includes a gas-filled chamber from which a rod 222 extends. The

protruding end 224 of the rod is affixed to a bottom of the structural member 112. An exemplary damper is identified by part number C16-17917 manufactured by Suspa, Inc., of Grand Rapids, Michigan.

As the crank handle 202 is rotated in a first direction to lower the rack coupling mechanism 114, the slider 210 moves downward and the upper and lower cables 216,218 move the damper 220 upwards such that the rod 222 is extended from the damper (FIG. 14). Thus, rotating the crank handle 202 in the first direction lowers the rack coupling mechanism 114. When the crank handle 202 is rotated in the opposite direction, the rod 22 retracts into the damper 220 as the slider 210 moves upward to raise the rack coupling mechanism 114 (FIG. 13).

FIGS. 15A-C show exemplary embodiments of a transfer system having an actuator 226 that includes a motor powered by an energy source (not shown), such as a wall socket. The motor can be contained within the structural member 112. An exemplary motor that is well-suited for use the transfer system is identified as part number 85152 manufactured by Motion Systems Corporation, of Eatontown, New Jersey. Alternatively, or in addition, the energy source can include a rechargeable energy source, e.g., a battery. The motor is effective to raise and lower the rack coupling mechanism 114 on the base element via respective up and down buttons 228,230. The motor 118 can further include a lock button (not shown) to prevent movement of the rack coupling mechanism. The motor should be able to easily raise a rack element fully loaded with portable patient care devices and to provide a damping function so as to limit the rate of downward movement.

It is understood that one of ordinary skill in the art can readily modify the actuator devices disclosed herein without departing from the present invention.

The rack 120 can have an array of configurations that are suitable for holding the various portable patient care devices. FIGS. 16A-B show exemplary embodiments of a rack 120 adapted for mating with the support member 122. The rack 120 can include a frame having one or more cross bars 250 attached to at least one vertical member 252, which can have multiple hooks or hangers 254 for supporting PPCDs. A coupling mechanism, such as

a pin 256, can be disposed at the base of the rack for engaging the support member 122. The central frame member 258 can be bowed to prevent any contact between supported devices and the top of the structural member as the rack is lowered. The rack can further include a handle 260 (FIG. 15C) to facilitate manual handling of the equipment support element.

FIGS. 17A-E, in combination with FIGS. 9 and 10, show an exemplary transfer of the equipment support element 102, which is shown supporting portable patient care devices, from the base element 106 to the bed 104. Initially, the equipment support element 102 is supported by the base element 106 (FIG. 17A). An operator activates the actuator 118, such as by rotating the crank handle in a predetermined direction to raise the rack coupling mechanism 114 to a level such that the bed pin 138 is above the bed frame 142 (FIG. 17B). The base element 106 is then moved into a position proximate the bed 104 such that the bed pin 138 is aligned with the corresponding socket 140 in the bed frame 142. The actuator 118 is again activated, such as by rotating the crank in the opposite direction, to lower the rack coupling mechanism 114 such that the bed pin 138 is captured in the corresponding socket 140 in the bed frame (FIG. 17C). As the rack coupling mechanism 114 continues to be lowered, the rack pin 130 exits the rack socket 132 in the housing 124 (FIG. 17D). The base element 106 is then completely disengaged from the equipment support element 102 and can be freely moved away from the bed (FIG. 17E).

When the equipment support element 102 is supported by the bed, the footprint of the bed/holder assembly is minimally increased as compared to the bed alone to enhance safe transport of the patient and the attached patient care devices. As used herein, the term "footprint" refers to the external dimensions of the hospital bed projected downward onto a floor surface and includes the equipment holder when the bed is supporting the patient care devices.

FIGS. 18A-E show the equipment support element 102 being transferred from the bed 104 to the base element 106. The rack coupling mechanism 114 is lowered (FIG. 18B) and positioned near the bed (FIG. 18C). The actuator 118 is energized to raise the rack

coupling mechanism 114 such that the rack pin 130 enters the corresponding rack socket 132 in the housing 124 (FIG. 18D). The rack coupling mechanism 114 is further raised to fully disengage the equipment support element 102 from the bed 106 such that it is supported by the base element 106..

In addition to the damper element 220 described above, the system can include further safety features as well. FIGS. 19A-B show the system having a locking mechanism 300 for preventing the rack coupling mechanism 114 (FIG. 9) from being lowered. In an exemplary embodiment, the locking mechanism 300 includes a latch member 302 having a first position (FIG. 19A), in which the latch extends from the structural member 112 to prevent rotation of the crank handle 220, and a second position (FIG. 19B), in which the crank handle is freely rotatable. In one embodiment, the latch member 302 is arcuate for capturing the crank handle. In a further embodiment, the latch member 302 is biased to one or both of the first and second positions to prevent unintended disengagement of the locking mechanism 300. It is understood that the locking mechanism 300 can be utilized to secure the rack 120 (FIG. 9) at discrete heights.

The portable patient care device transfer system can further include a hospital bed having a level detection mechanism for ensuring that the bed frame is level prior to engaging the equipment support mechanism 102. Exemplary mechanisms include bubble type and electronic levels, switches to automatically level the bed within predetermined ranges, and switches for leveling the bed that must be activated prior to the bed receiving the equipment support element. The leveling and/or level detection mechanisms can also include visual and/or audible warning indicators that can be activated when the bed is not level, and/or mechanisms that automatically level the bed when the base element is moved within a predetermined distance from the bed. These mechanisms reduce the likelihood of an unstable coupling of the equipment support element and the bed.

FIG. 20 shows a transfer system in accordance with the present invention that includes a bed 400 having a level detection mechanism 500 that levels the intermediate frame portion 402 of the bed. The level detection mechanism 500 includes a switch 502 that can

be actuated by an operator to automatically level the bed prior to receiving the equipment support element. The mechanism can include a bubble-type level to provide confirmation that the bed is indeed level. In one embodiment, the level detection mechanism 500 detects the equipment support element when it is within a predetermined distance and provides a warning when the bed is not level.

In another aspect of the invention, a transfer system can include various power distribution and data communication equipment that can be secured to the equipment holder, such as on the rack. FIG. 21 shows a portable patient care device transfer system 600 including an electrical box 602, which can be secured to the rack 604, having AC outlets 606 and DC ports 608 for supplying power to supported PPCDs. In one embodiment, the electrical box includes a rechargeable energy source for energizing a portable patient care device.

FIG. 22 shows a portable patient care device 700 including a data communication device 702 for receiving and/or transmitting information to and from a remote system (not shown). The device 702 can communicate to the remote system via wires, optical fibers, so-called line-of-sight, and wireless techniques. In an exemplary embodiment, the data communication device 702 receives from and transmits to the remote device using wireless technology. The communications device 702 includes a series of data communication ports 704 for coupling PPCDs to the remote system via the data communication device.

This arrangement can provide remote monitoring and control of the PPCDs. For example, an IV type of patient care device can be monitored remotely using a sensor that measures the fluid flow rate. When the flow rate falls below a predetermined threshold, an alarm or other indication can be sounded or flashed to a display screen at central nurse's station, for example. The IV device provides a signal to the data communication device 702, which transmits the information to the remote station. A nurse, for example, receives data on the display indicating the patient, the device, and the sensor information, e.g. low flow rate. Similarly, a nurse may be notified by the remote station, for example, that a certain patient should now have an additional fluid added to an IV drip. In the case where a

device is previously set up, the nurse can transmit a signal to the data communication device 702 on the patient's rack that activates a certain device such that the additional fluid is now provided to the patient. The flow rate of the additional fluid can be monitored by a sensor to ensure proper administration of the fluid.

It is understood that many other types of devices can be controlled remotely using a data communication device that forms a part of the transfer system of the present invention.

The above-described PPCD transfer system provides rapid and safe transfer of a relatively heavy rack supporting patient care devices between a mobile base unit and the patient's bed. The system allows the transfer to occur without the need for adjusting the height of the bed. Further, the bed need not be manipulated to a predetermined height in order to transfer the rack. The transfer can be accomplished with relative ease in the order of seconds.

In addition, the PPCD transfer system can include various safety features described above to enhance the safe operation of the system and prevent rapid dropping the relatively heavy rack. In addition, the height of the rack element can be adjusted to discrete positions. The system also obviates the need for an operator to lift the relatively heavy rack. Since no lifting is required, the likelihood of back injuries due to equipment transfers is greatly reduced.

One skilled in the art will appreciate further features and advantages of the invention based on the above-described embodiments. Accordingly, the invention is not to be limited by what has been particularly shown and described, except as indicated by the appended claims. All publications and references cited herein are expressly incorporated herein by reference in their entirety.

What is claimed is:

1. A transfer system for portable patient care devices, comprising:

an equipment holder element including

a rack for holding the portable patient care devices;

a support member supporting the rack;

a housing from which the support member extends;

a bed coupling mechanism connected to the housing; and

a base coupling mechanism connected to the housing; and

a mobile base element including

a platform member;

a structural member extending from the platform;

a rack coupling mechanism movably secured to the structural member for selectively engaging the base coupling mechanism to support the equipment holder; and

an actuator for raising and lowering the rack coupling mechanism on the structural member to selectively transfer the equipment holder between a patient's hospital bed and the base element.

2. The system according to claim 1, wherein the rack coupling mechanism includes an upwardly open socket.

3. The system according to claim 2, wherein the base coupling mechanism includes a pin for engaging the socket of the rack coupling mechanism.

4. The system according to claim 2, wherein the socket is offset from a longitudinal axis of the structural member.

5. The system according to claim 2, wherein the socket is aligned with a longitudinal axis of the support member.

6. The system according to claim 1, wherein the bed coupling mechanism includes a pin extending from a bottom of the housing.

7. The system according to claim 6, wherein the pin is offset from a longitudinal axis of the support member.

8. The system according to claim 1, wherein the actuator includes a crank handle for mechanically raising and lowering the rack coupling mechanism.

9. The system according to claim 1, wherein the actuator includes an electric motor.

10. The system according to claim 1, wherein the actuator includes a locking mechanism for preventing movement of the rack coupling mechanism.

11. The system according to claim 1, wherein the actuator includes a damper for limiting a rate of downward movement of the rack coupling mechanism.

12. The system according to claim 1, wherein the equipment holder element further includes an electrical power distribution box for powering the portable patient care devices.

13. The system according to claim 1, wherein the equipment holder element further includes a data communications device for providing data communication between the portable patient care devices and a remote device.

14. The system according to claim 13, wherein the data communications device provides wireless communication with the remote device.

15. A portable patient care device transfer system, comprising:

an equipment holder element including

a rack for holding the portable patient care devices;

a support member supporting the rack;

a housing from which the support member extends;

a bed coupling mechanism connected to the housing; and

a base coupling mechanism connected to the housing; and

a mobile base element including

a platform member;

a structural member extending from the platform;

a rack coupling mechanism movably secured to the structural member for selectively engaging the base coupling mechanism to support the equipment holder; and

an actuator for raising and lowering the rack coupling mechanism on the structural member to selectively transfer the equipment holder between a patient's hospital bed and the base element; and

a hospital bed including a frame having a coupling mechanism for engaging the bed coupling mechanism of the housing to support the equipment holder element.

16. The system according to claim 15, wherein the coupling mechanism of the hospital bed includes a socket.

17. The system according to claim 15, wherein the coupling mechanism of the hospital bed is removably securable to the bed.

18. The system according to claim 15, wherein the hospital bed includes a level detection mechanism.

19. The system according to claim 18, wherein the level detection mechanism includes a bubble type level.

20. The system according to claim 18, wherein the level detection mechanism includes a switch for automatically leveling the bed.

21. The system according to claim 15, wherein the equipment support element further includes a power source for the portable patient care devices.

22. The system according to claim 15, wherein the equipment support element further includes a data communications device for providing data communication between the portable patient care devices and a remote device.

23. The system according to claim 22, wherein the data communications device provides wireless data communication with the remote device.

24. A method of transferring portable patient care devices from a hospital bed, comprising:

lowering a rack coupling mechanism movably secured to a structural member that forms a part of a mobile base element;

aligning the rack coupling mechanism with a base coupling mechanism connected to a housing from which a support member extends and supports a rack element; and

raising the rack coupling mechanism until the base element supports the rack element.

25. A method of transferring portable patient care devices to a hospital bed, comprising:

raising a rack coupling mechanism movably secured to a structural member that forms a part of a mobile base element;

aligning a coupling mechanism on the hospital bed with a bed coupling mechanism connected to a housing from which a support member extends and supports a rack element; and

lowering the rack coupling mechanism until the bed supports the rack element.

5

26. The method according to claim 19, further including determining whether the hospital bed is level prior to engaging bed coupling mechanism with the hospital bed.

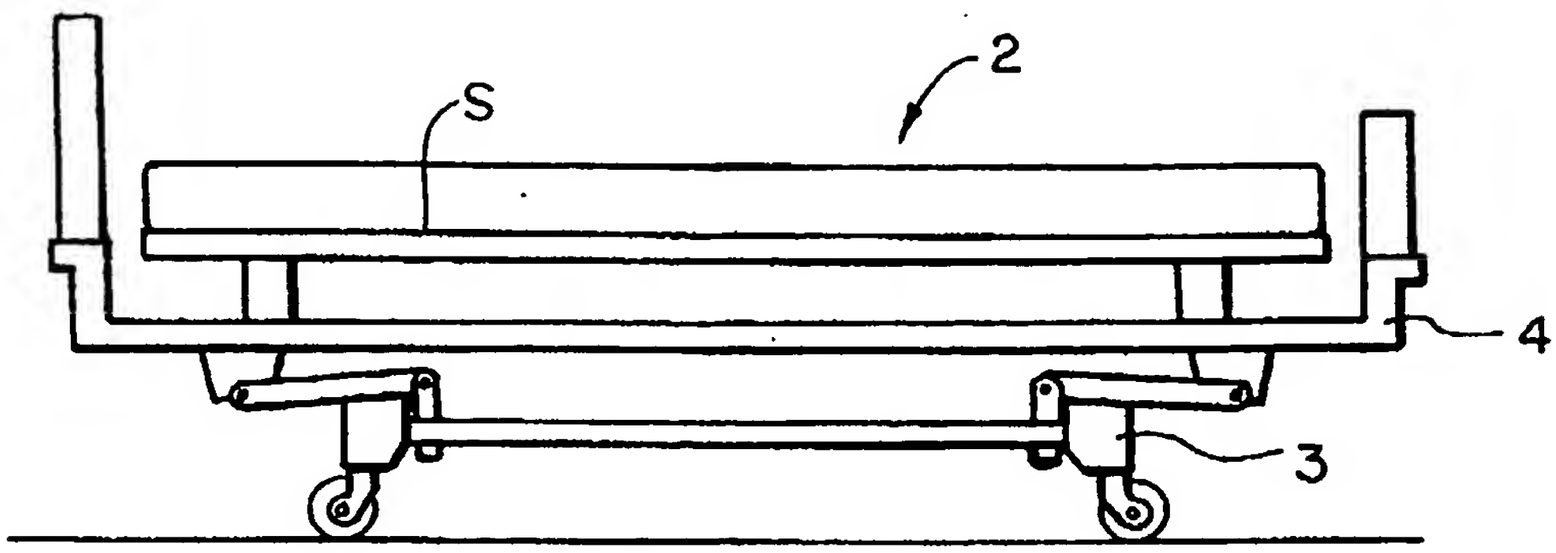


FIG. 1A
PRIOR ART

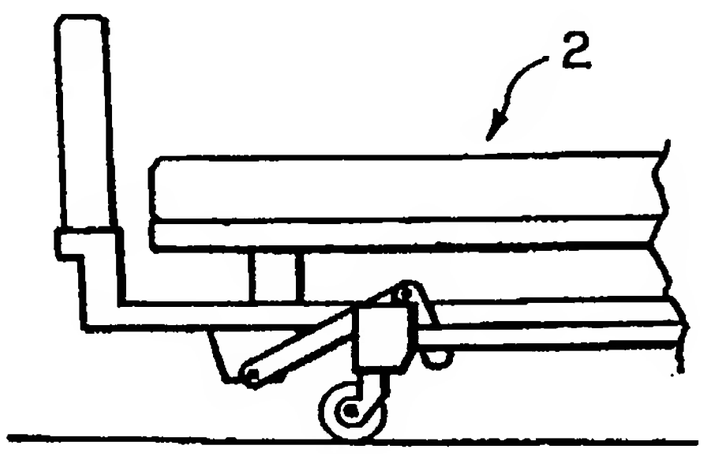


FIG. 1B
PRIOR ART

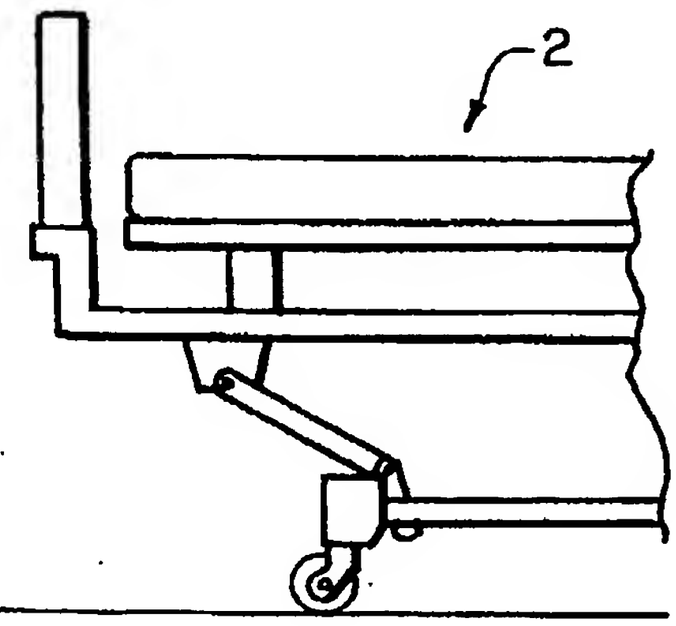


FIG. 1C
PRIOR ART

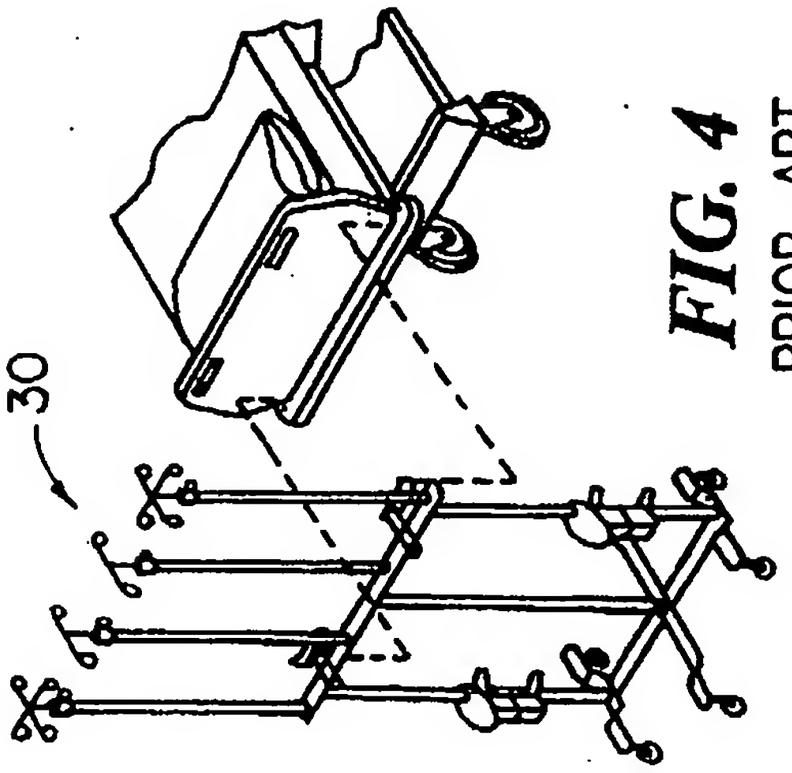


FIG. 4
PRIOR ART

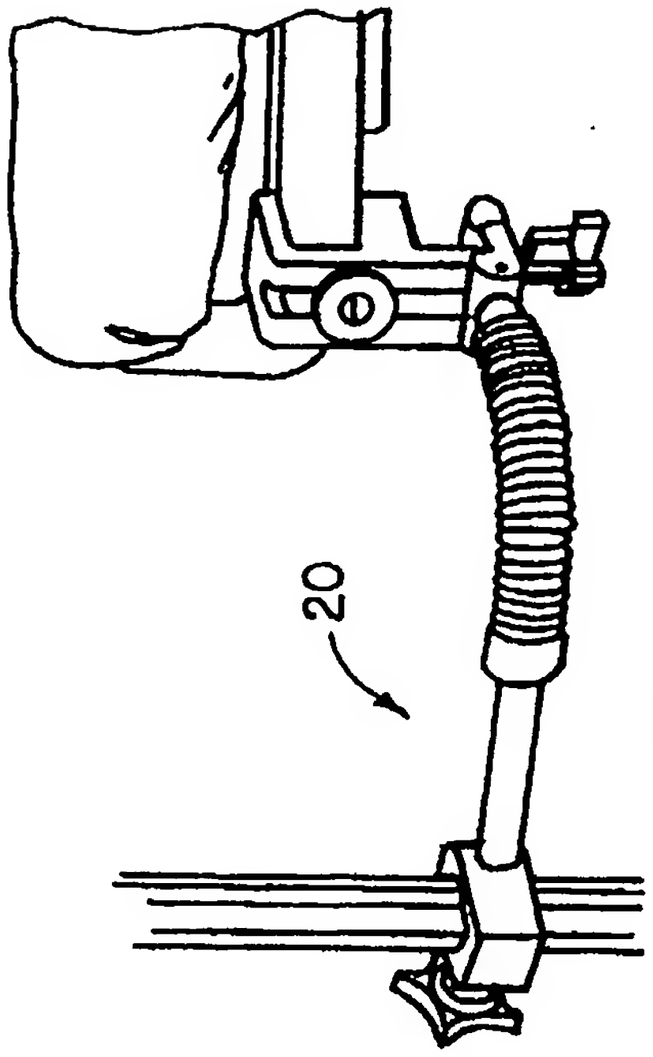


FIG. 3
PRIOR ART

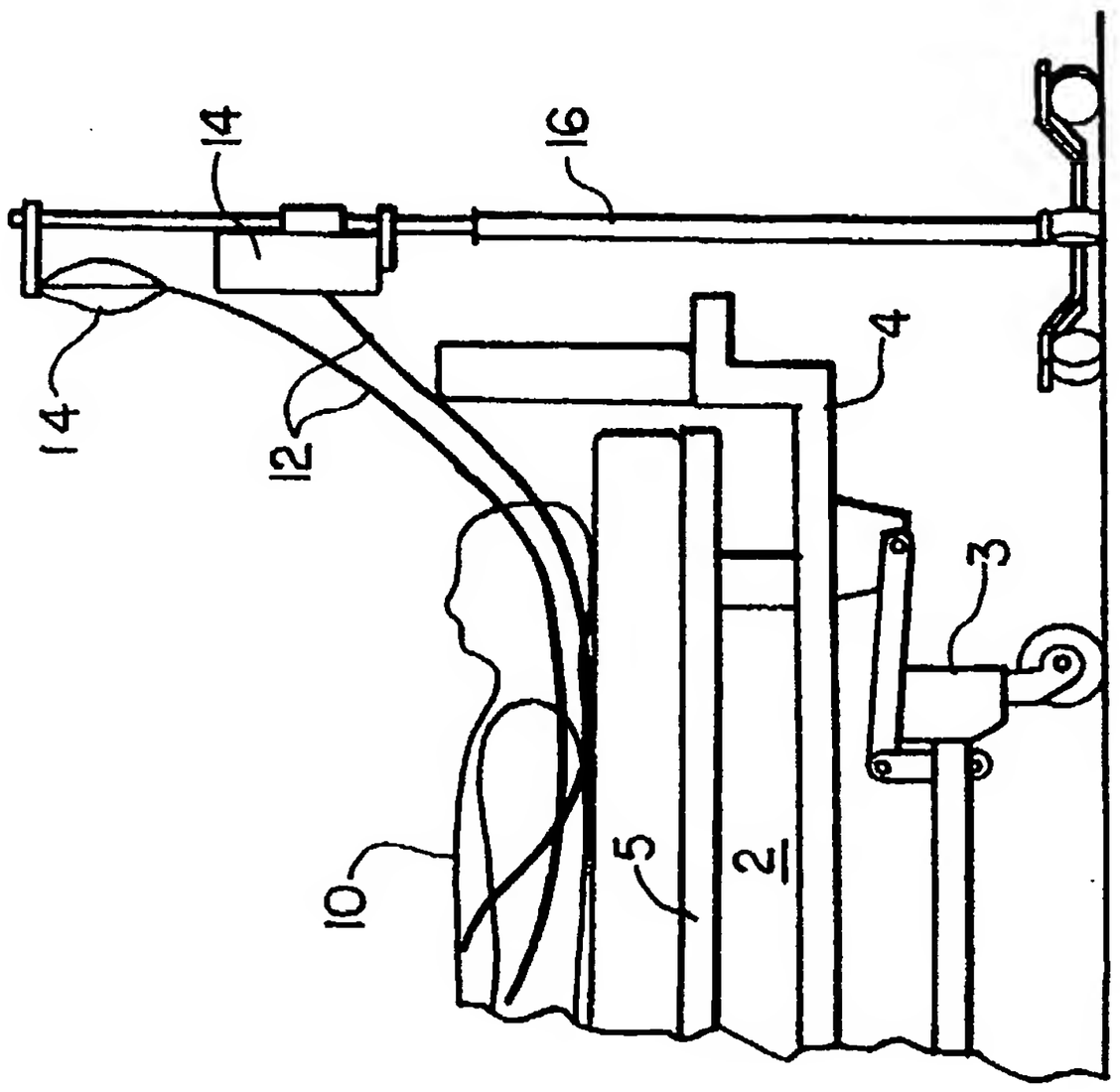


FIG. 2
PRIOR ART

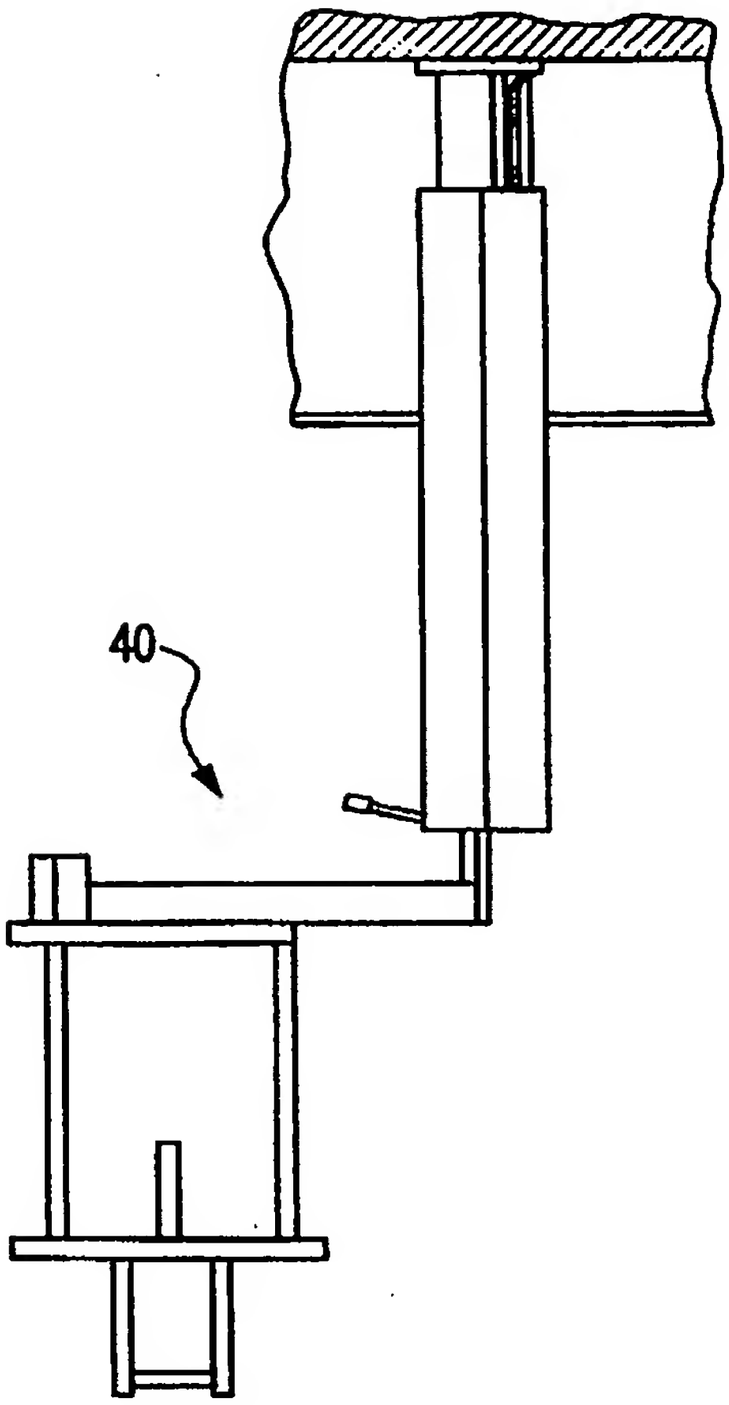


FIG. 5A
PRIOR ART

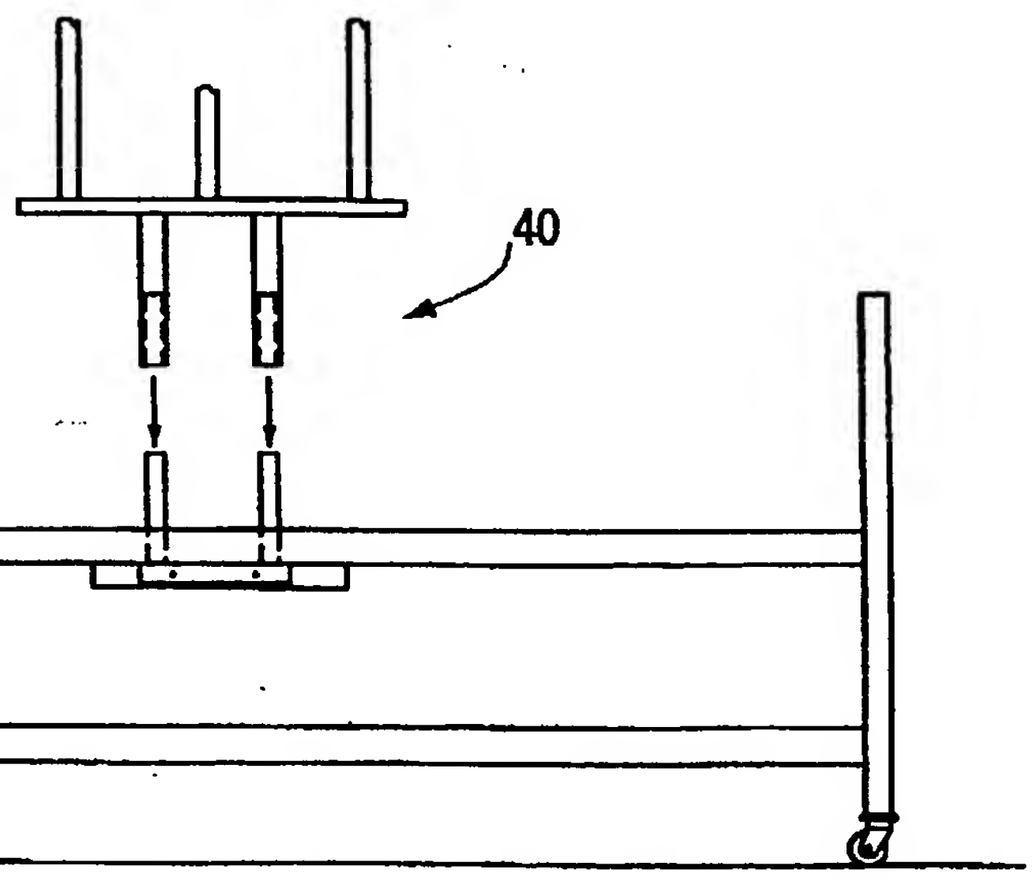


FIG. 5B
PRIOR ART

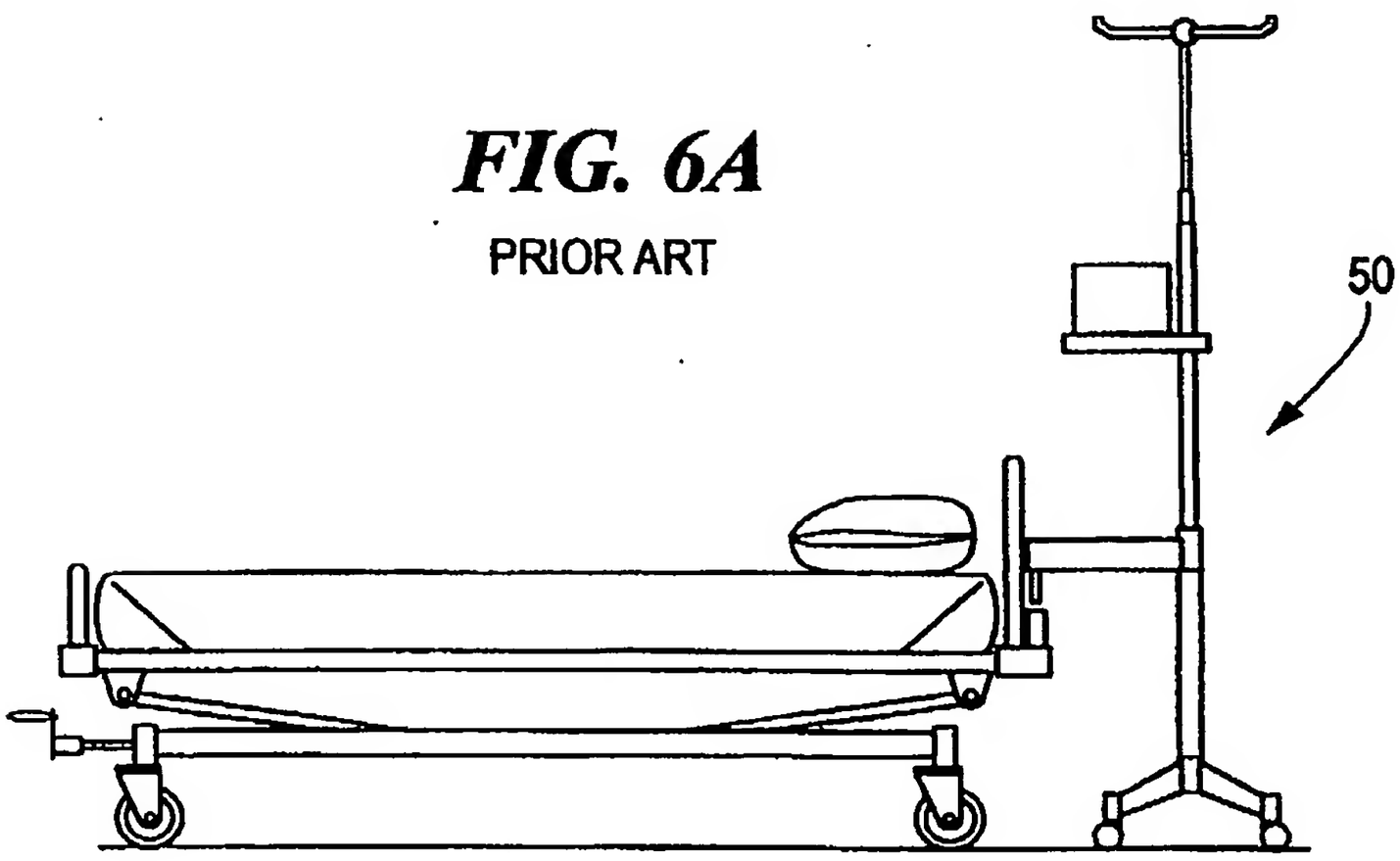


FIG. 6A
PRIOR ART

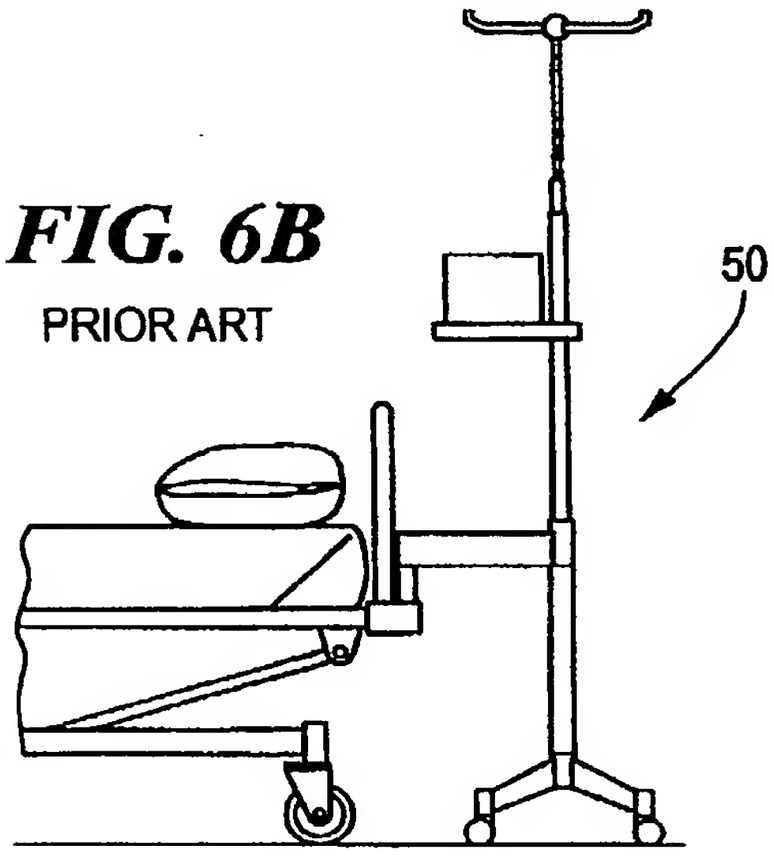


FIG. 6B
PRIOR ART

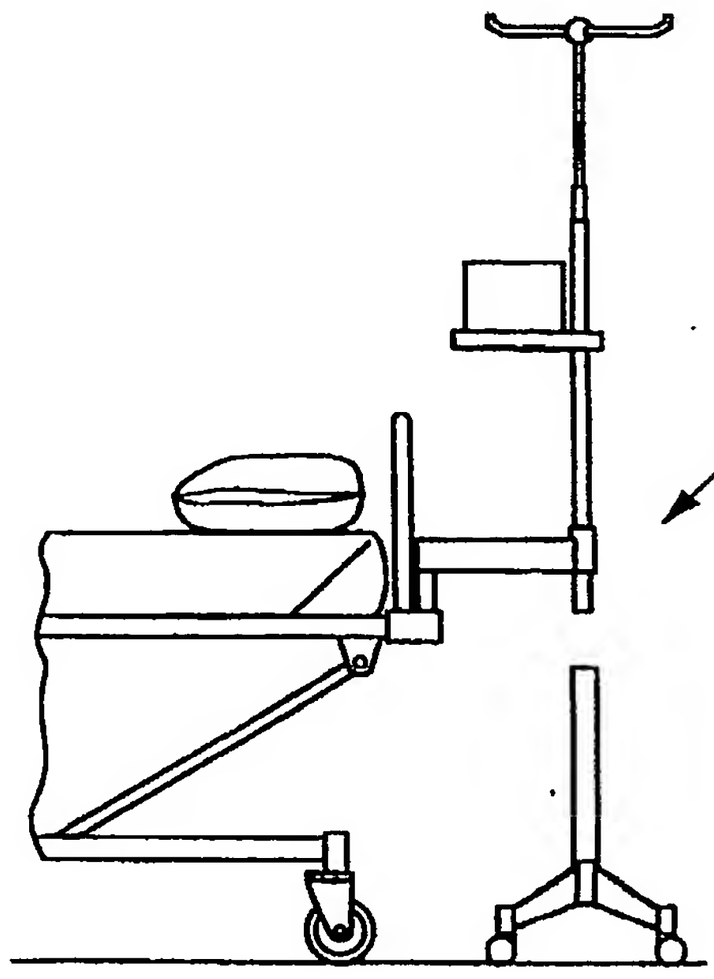


FIG. 6C
PRIOR ART

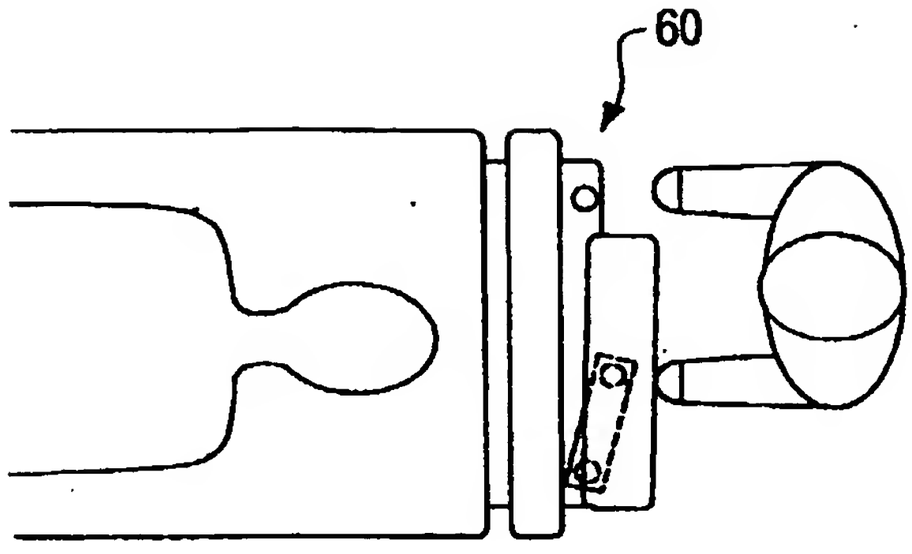


FIG. 7A
PRIOR ART

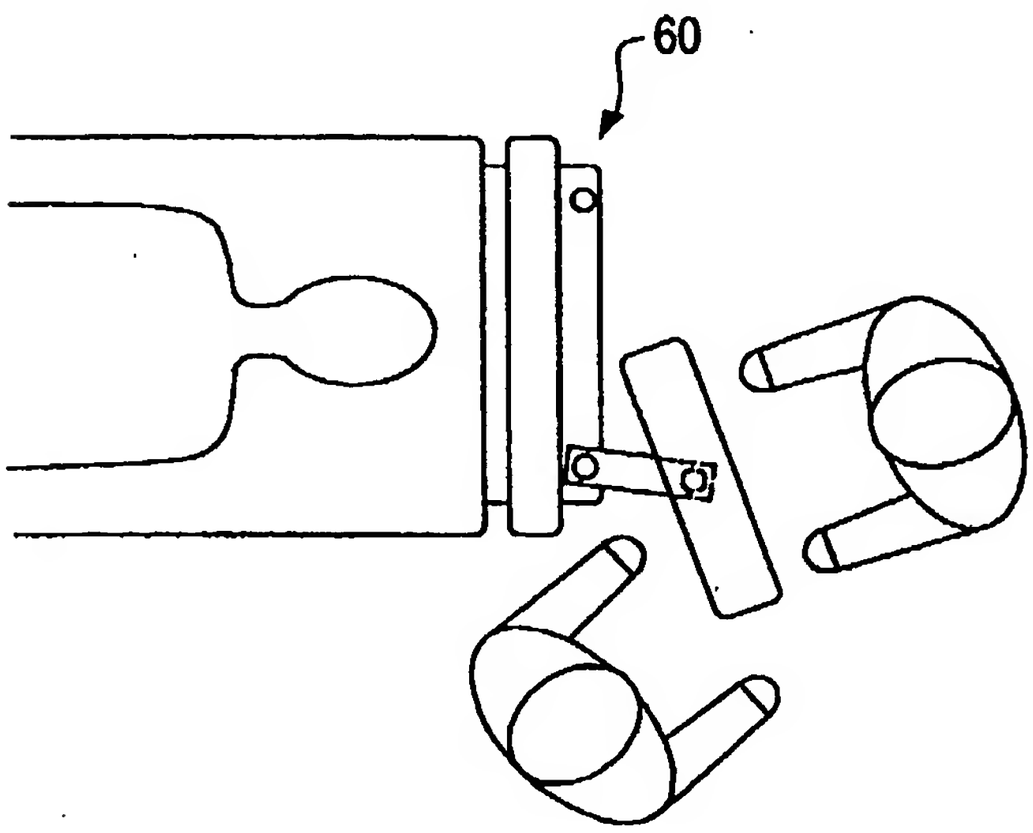


FIG. 7B
PRIOR ART

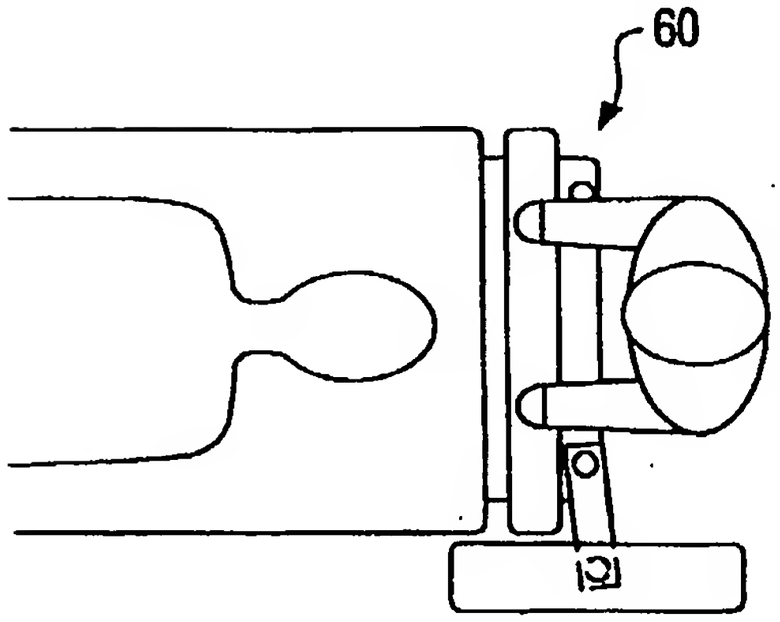


FIG. 7C
PRIOR ART

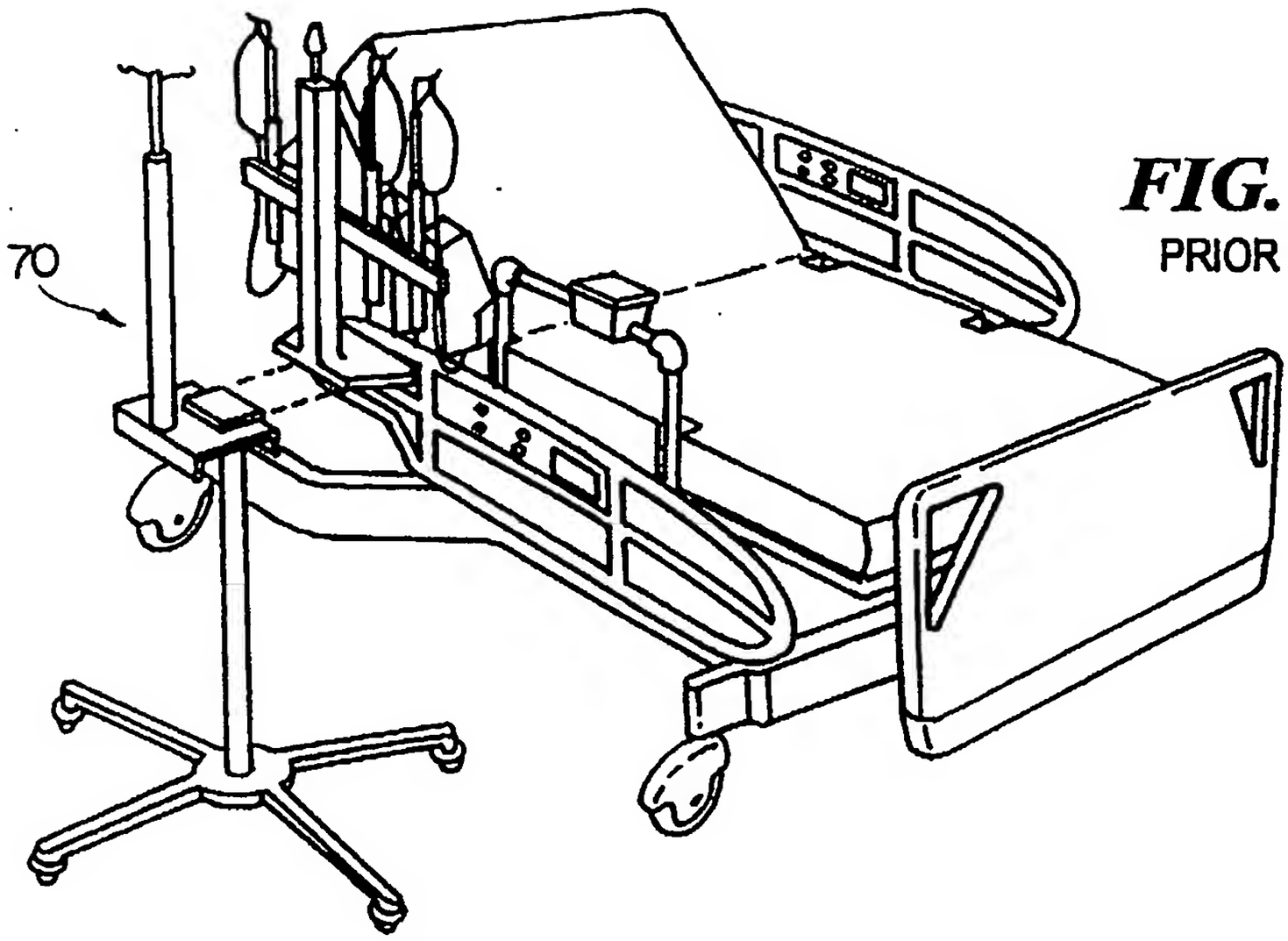


FIG. 8A
PRIOR ART

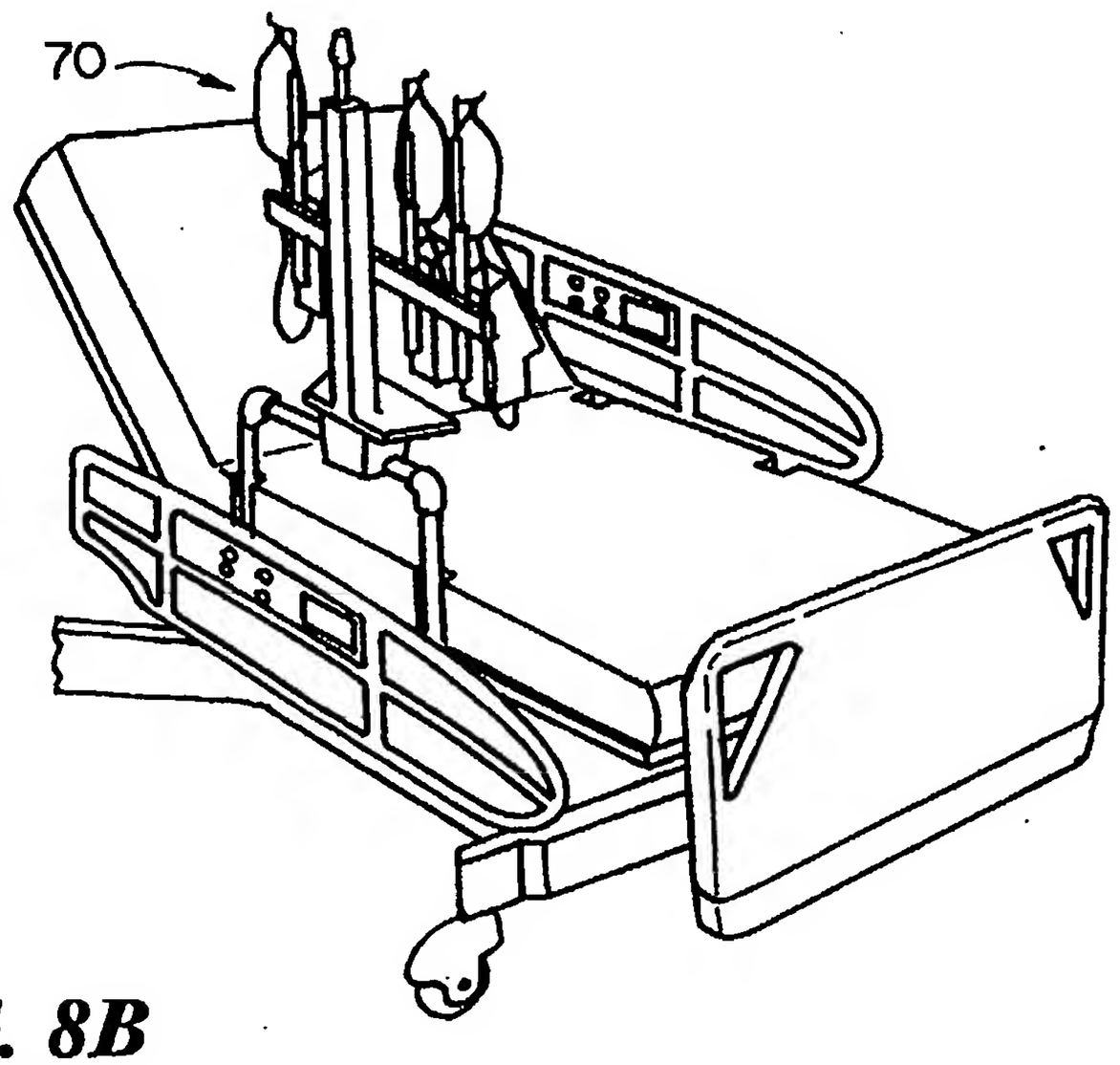


FIG. 8B
PRIOR ART

FIG. 9

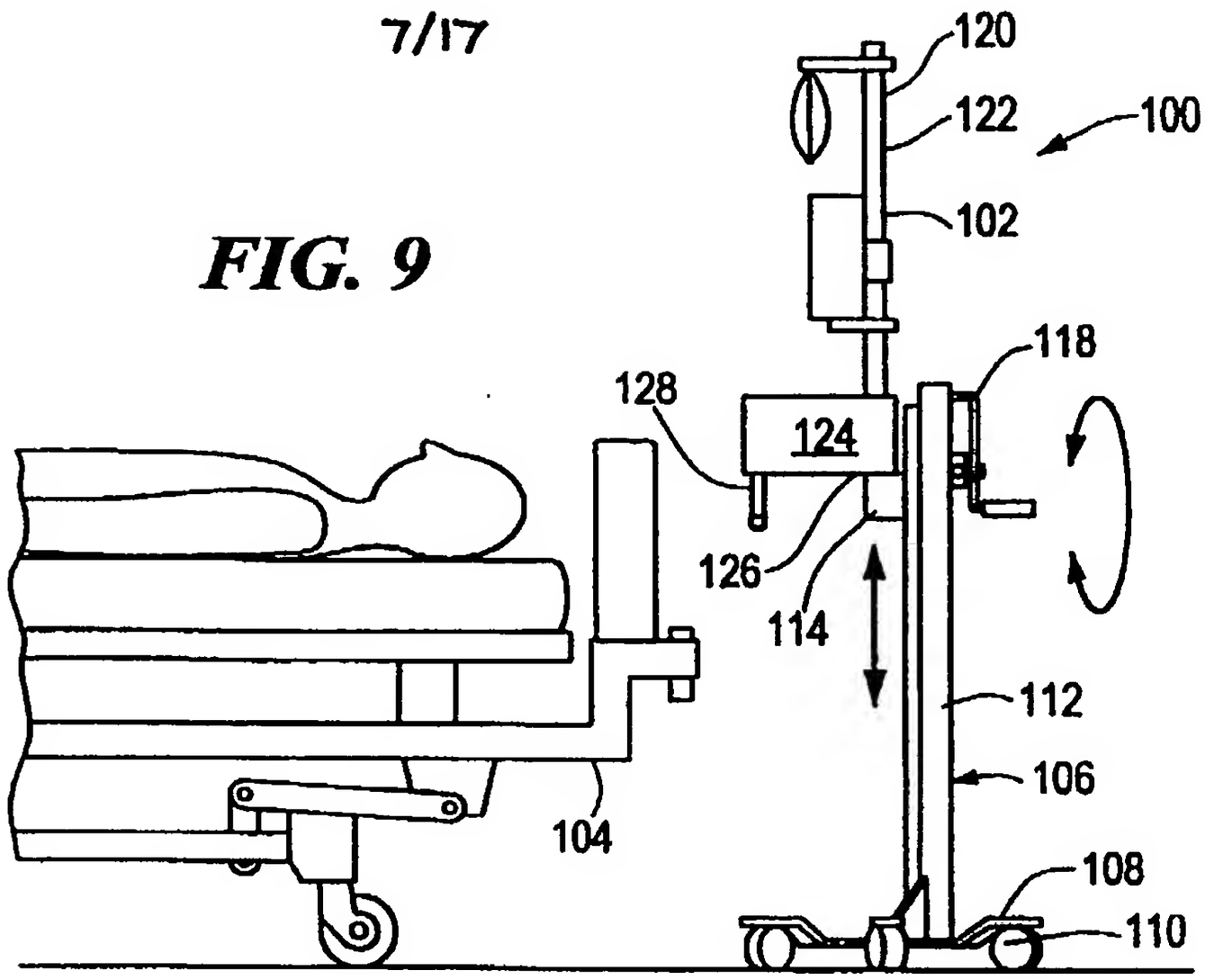
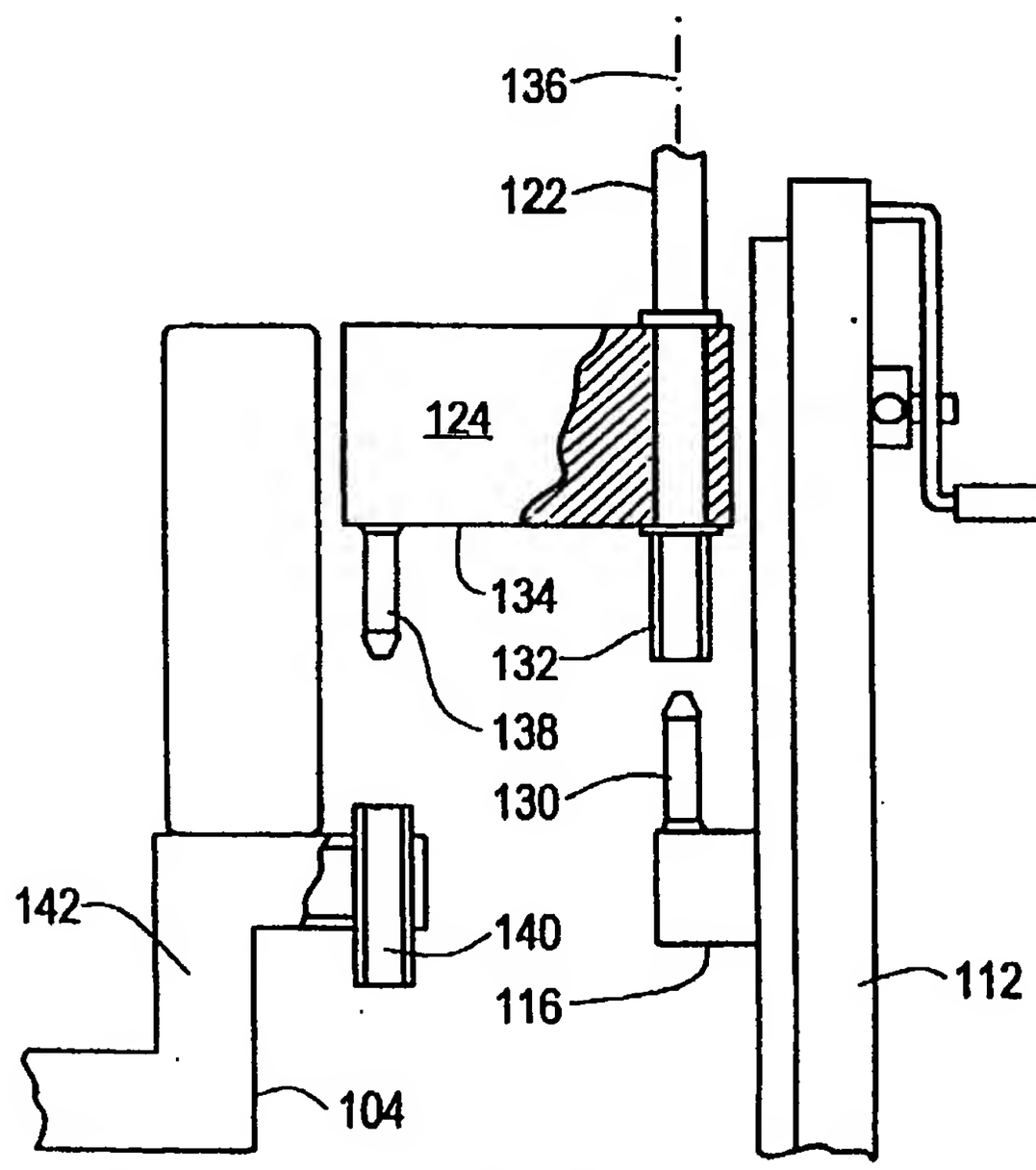

120
122
100
102
118
128
124
126
114
112
106
108
110
104

FIG. 10


136
122
124
134
132
138
130
142
140
116
112
104

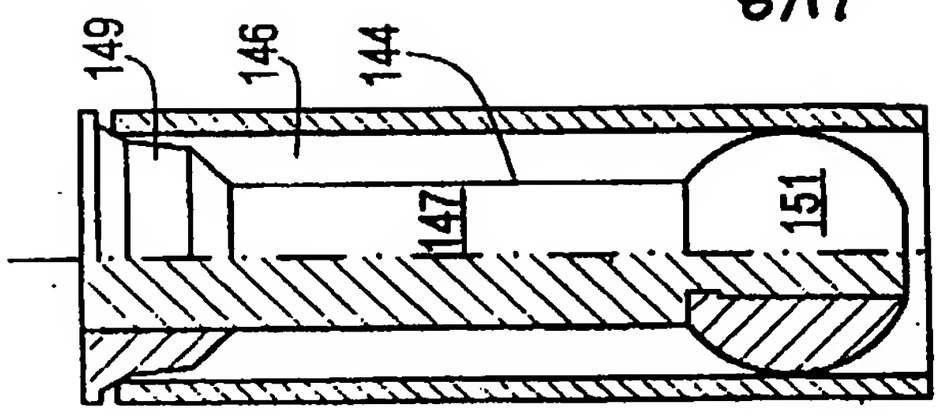


FIG. 12A

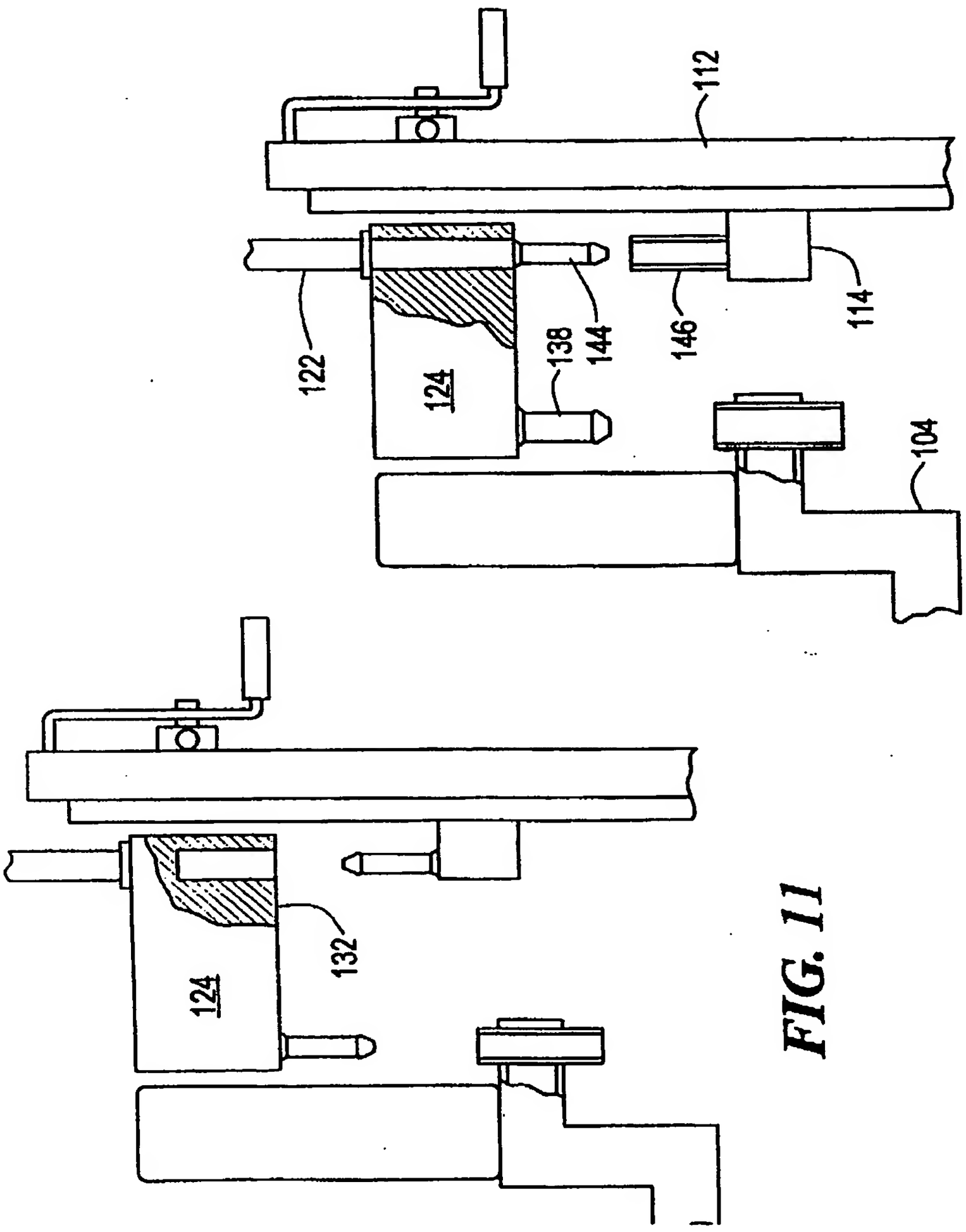


FIG. 12

FIG. 11

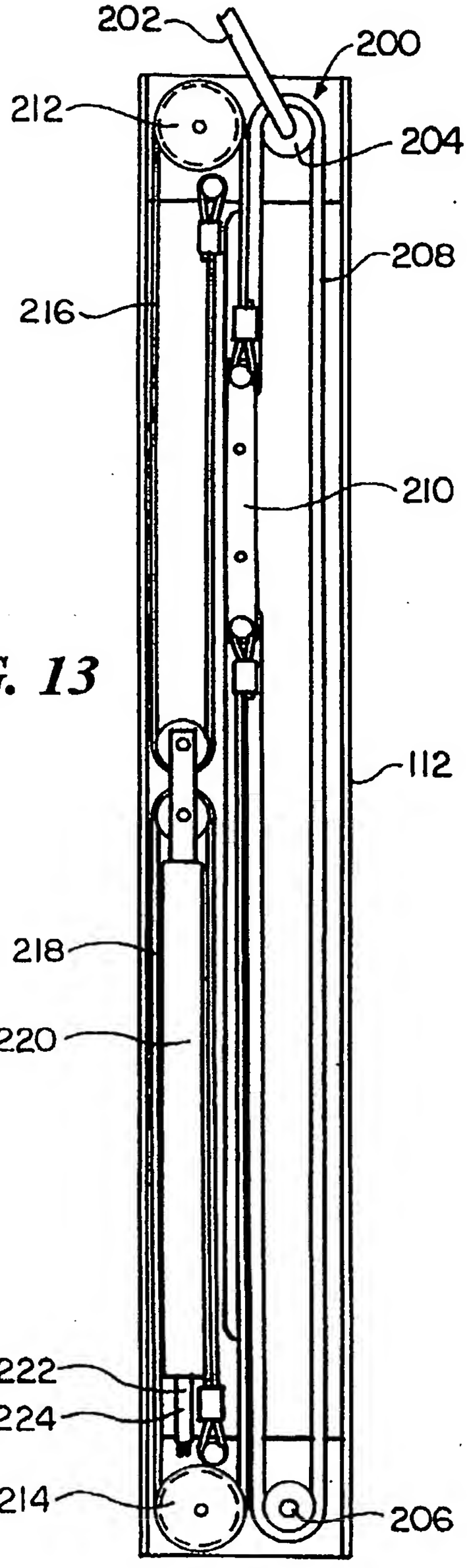


FIG. 13

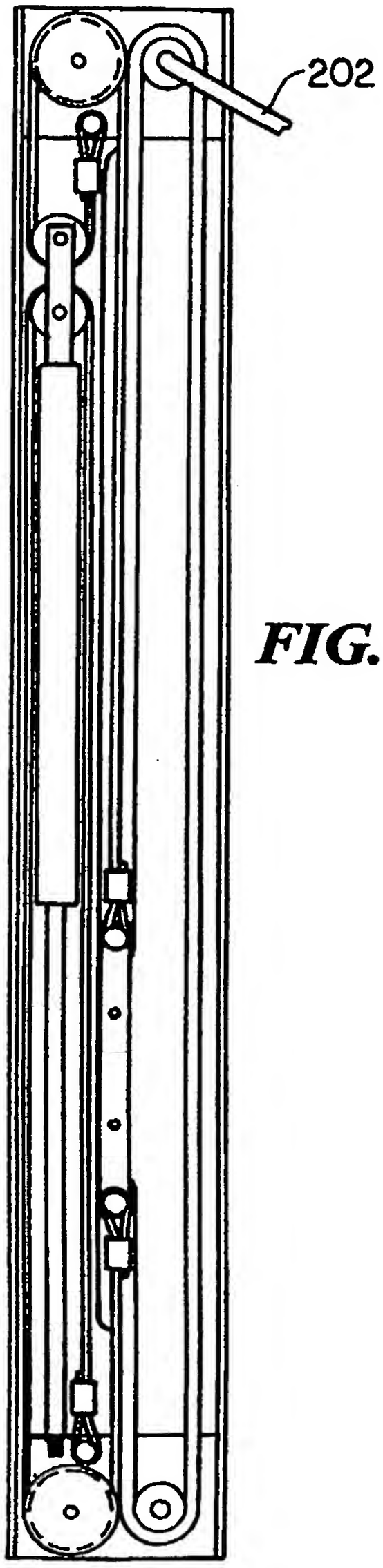


FIG. 14

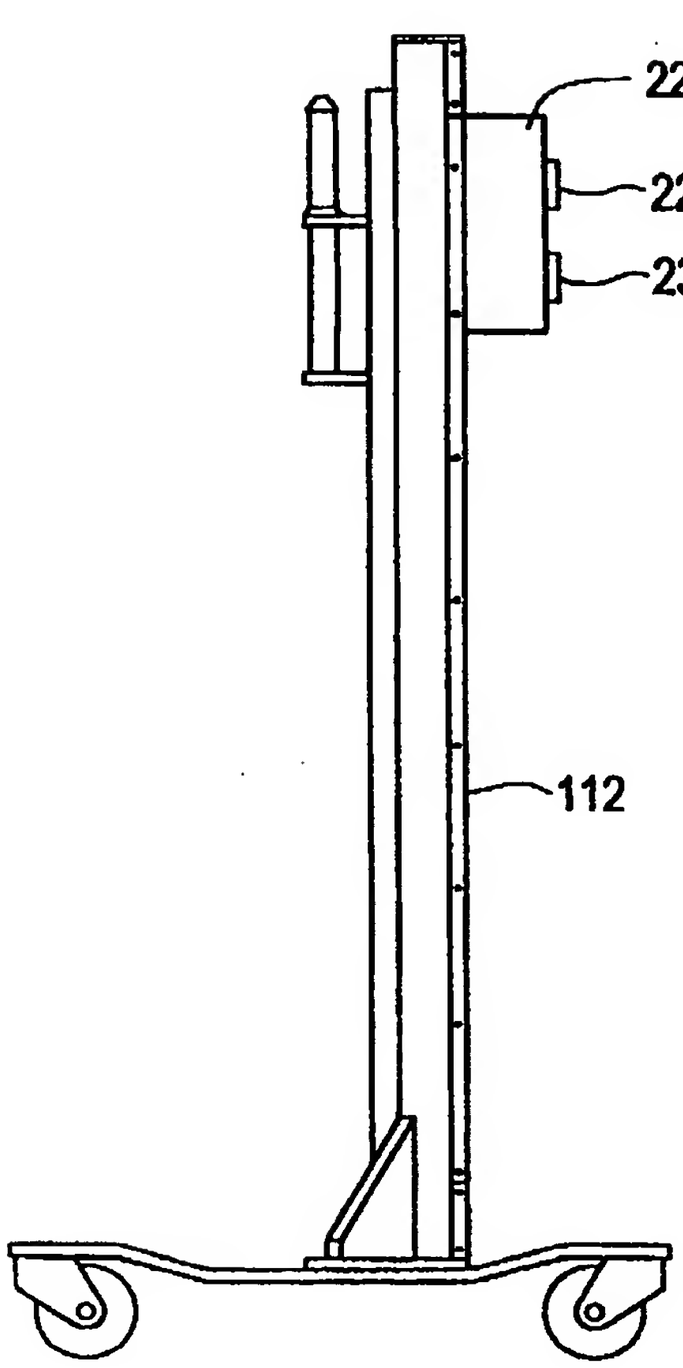


FIG. 15A

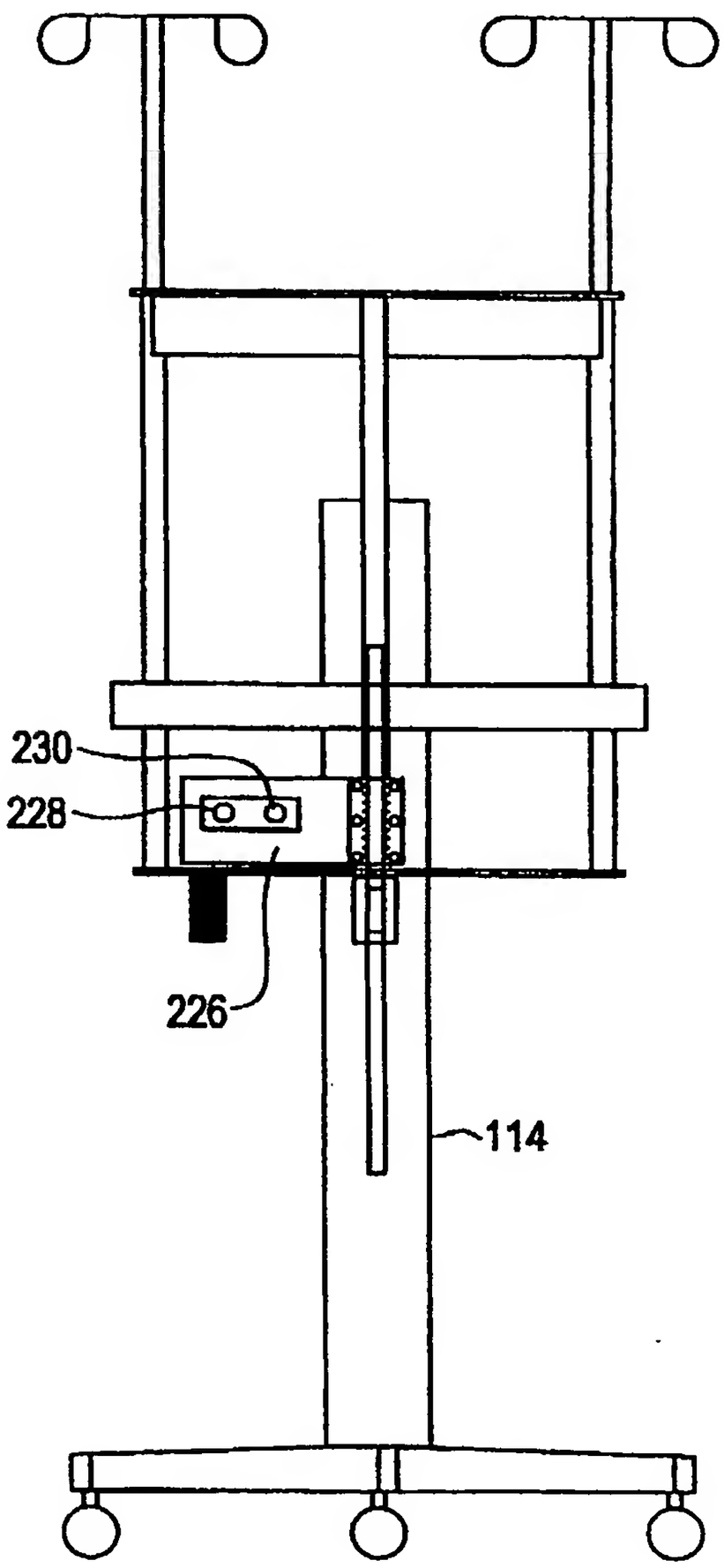


FIG. 15B

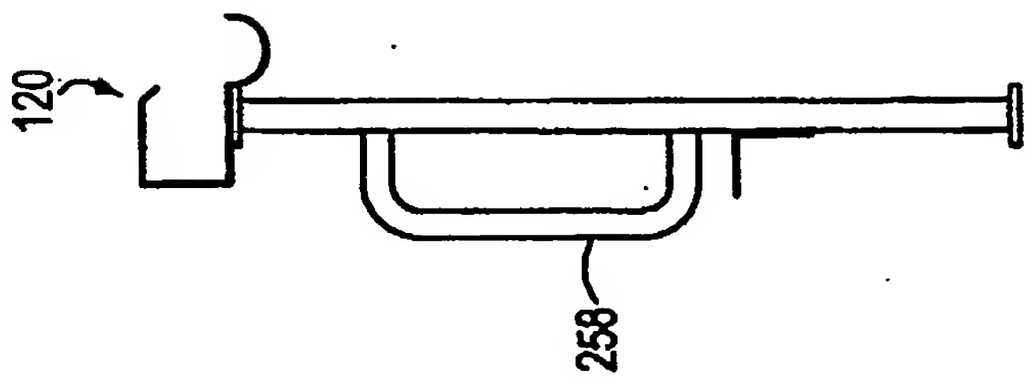


FIG. 16B

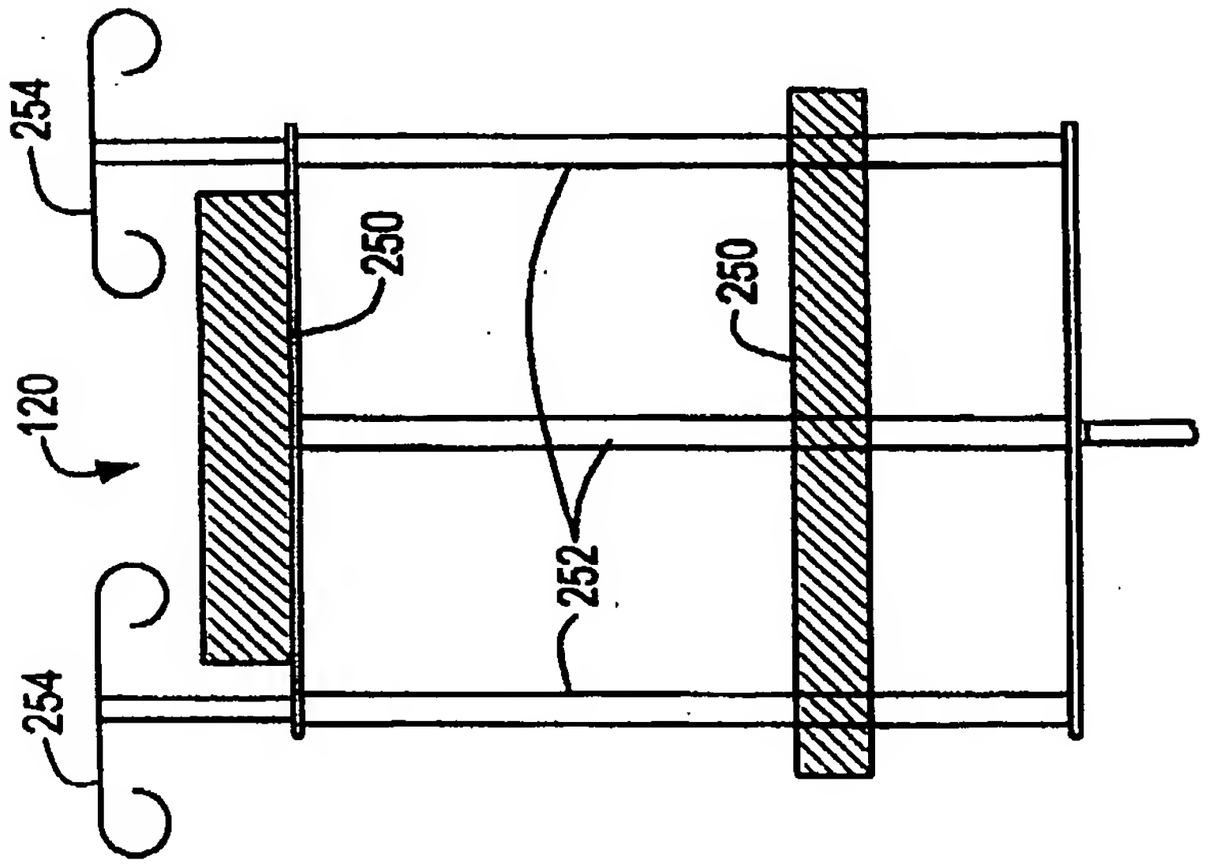


FIG. 16A

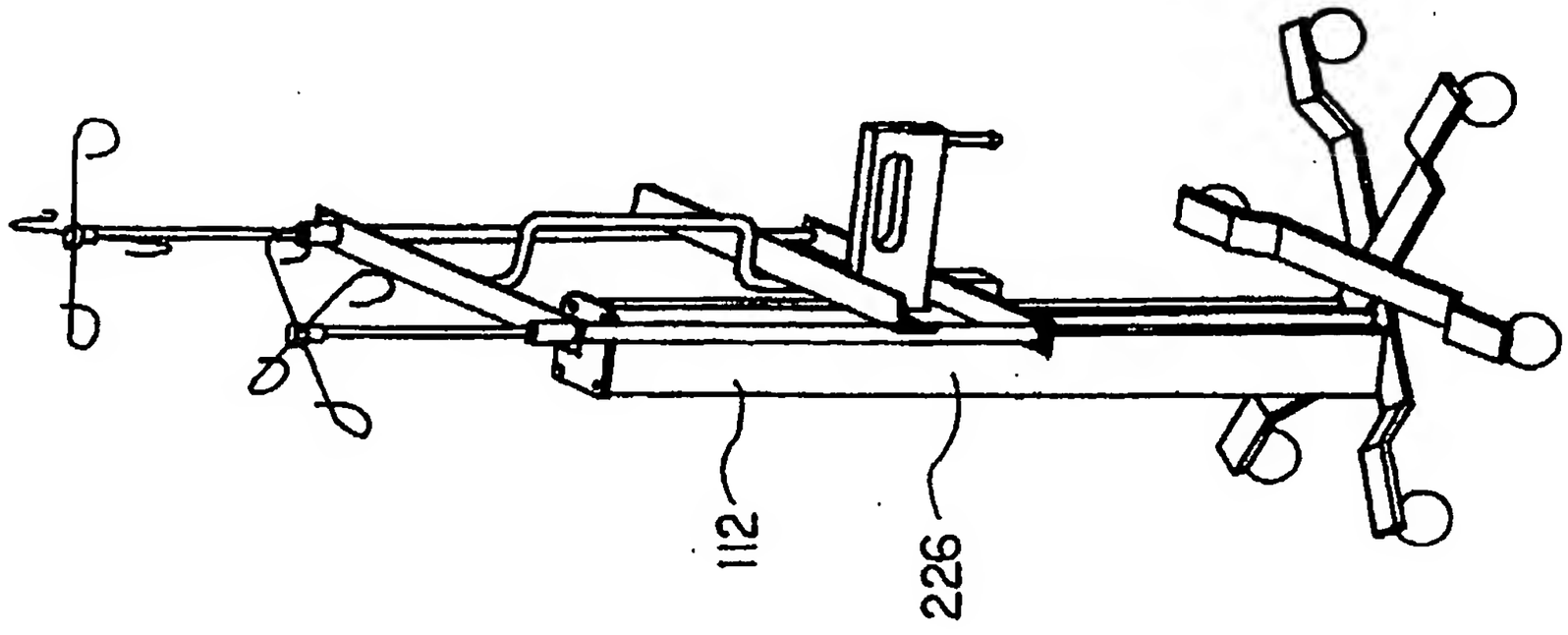


FIG. 15C

FIG. 17A

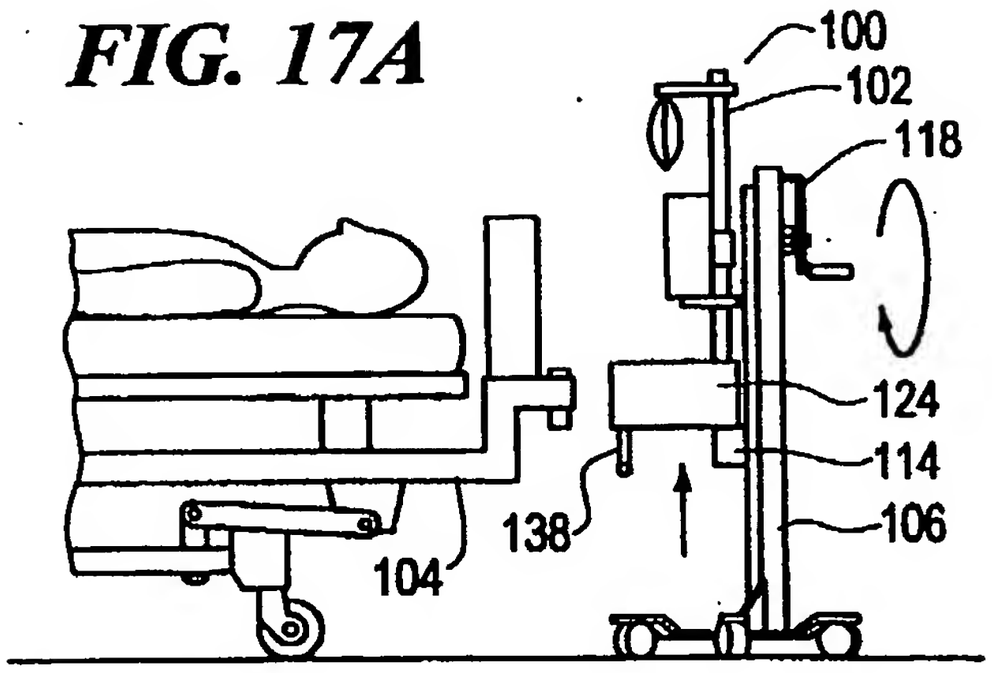


FIG. 17B

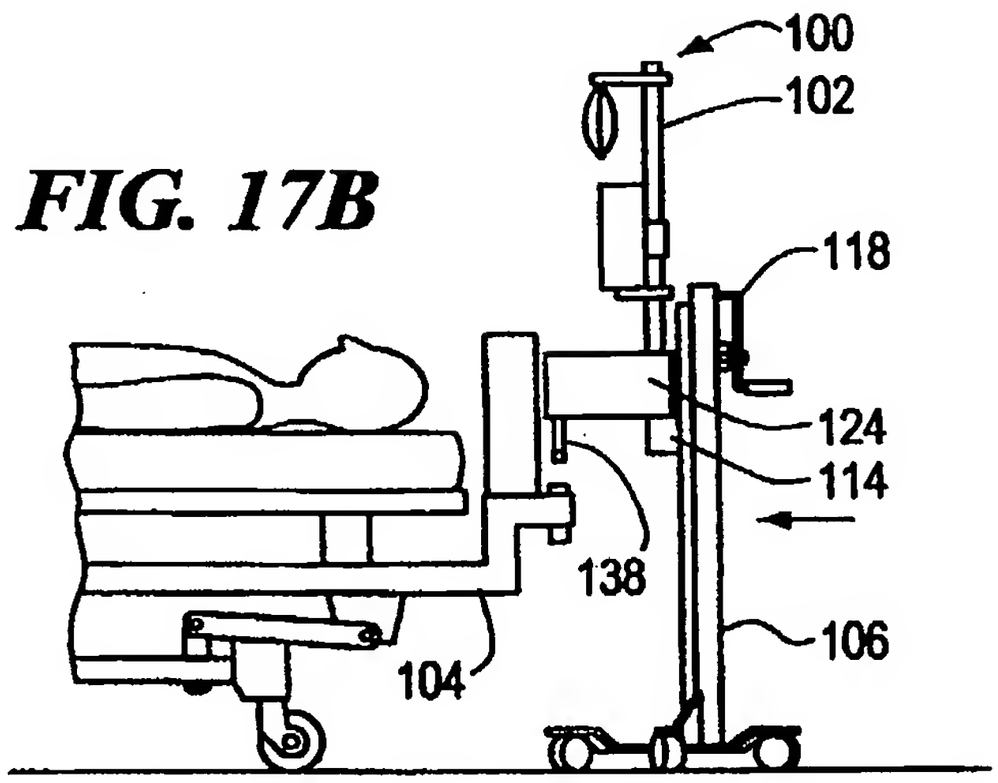
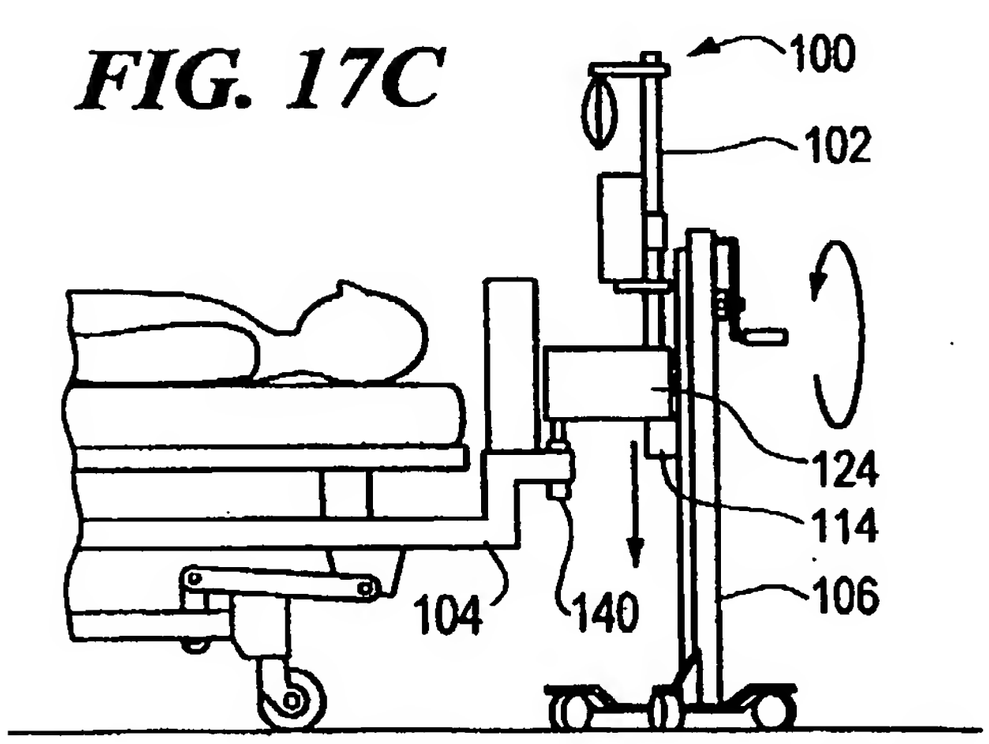


FIG. 17C



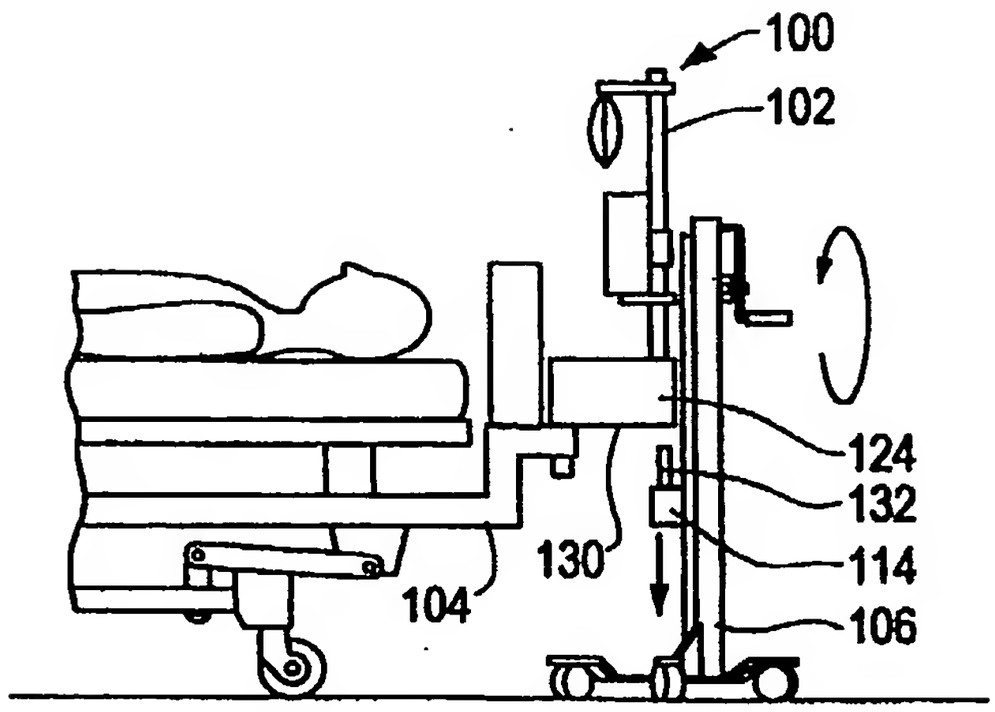


FIG. 17D

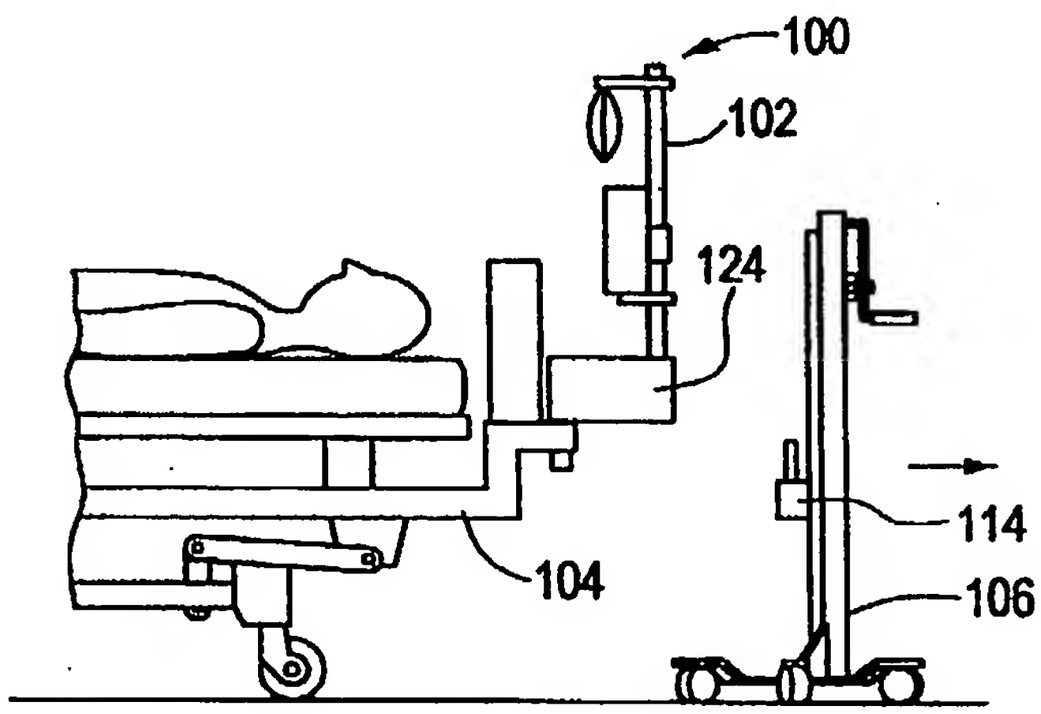


FIG. 17E

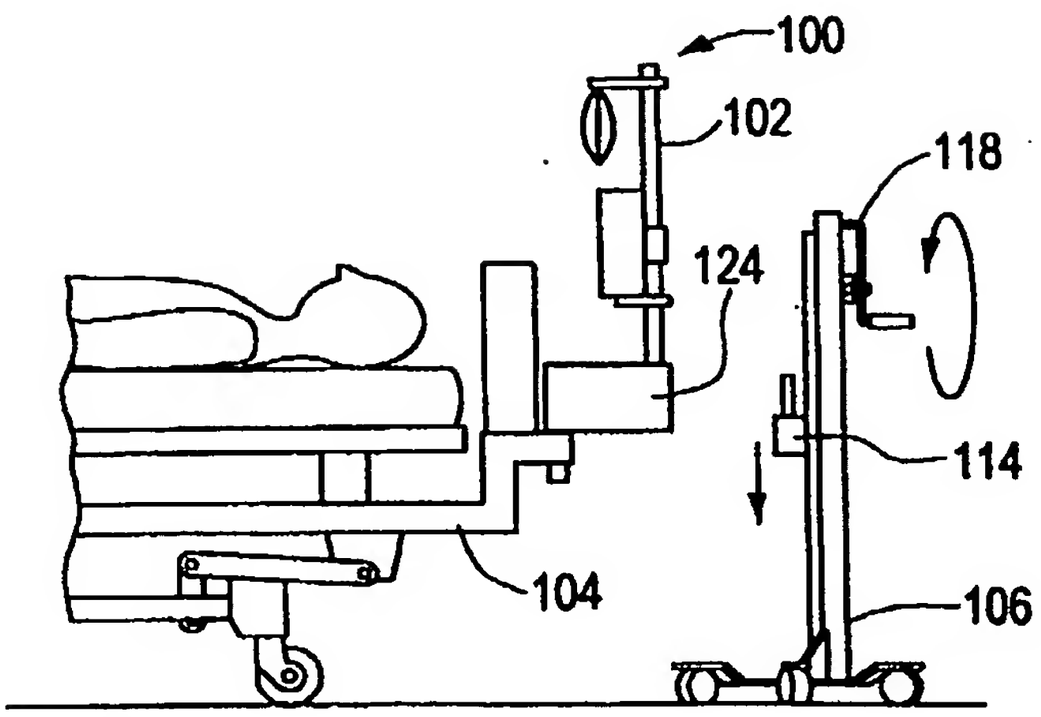


FIG. 18A

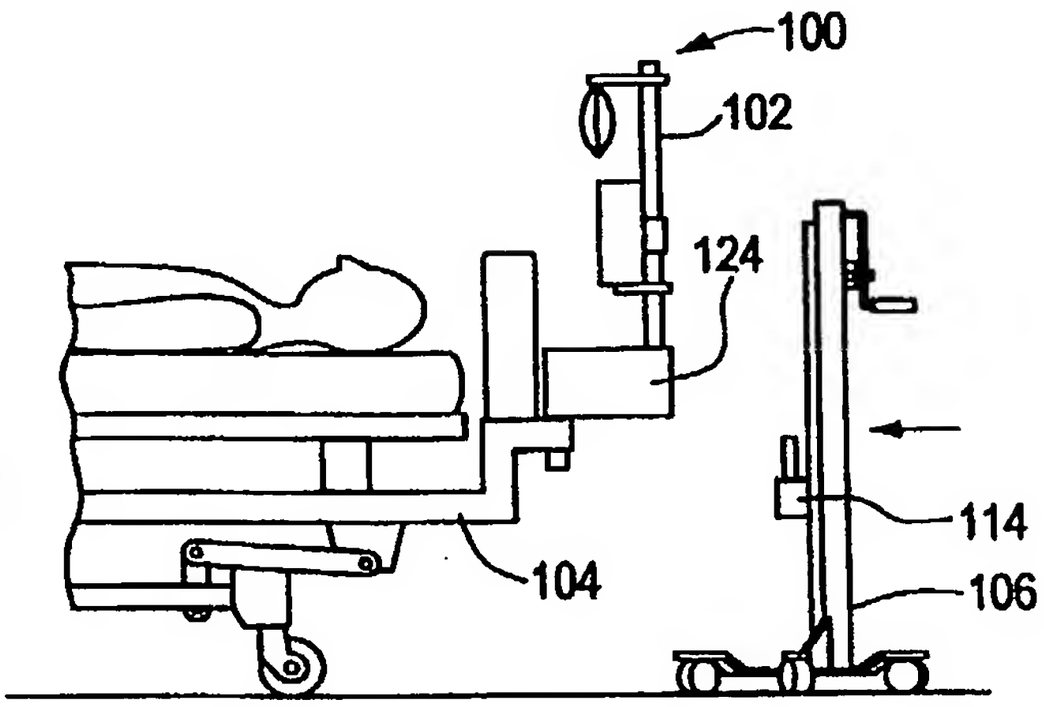


FIG. 18B

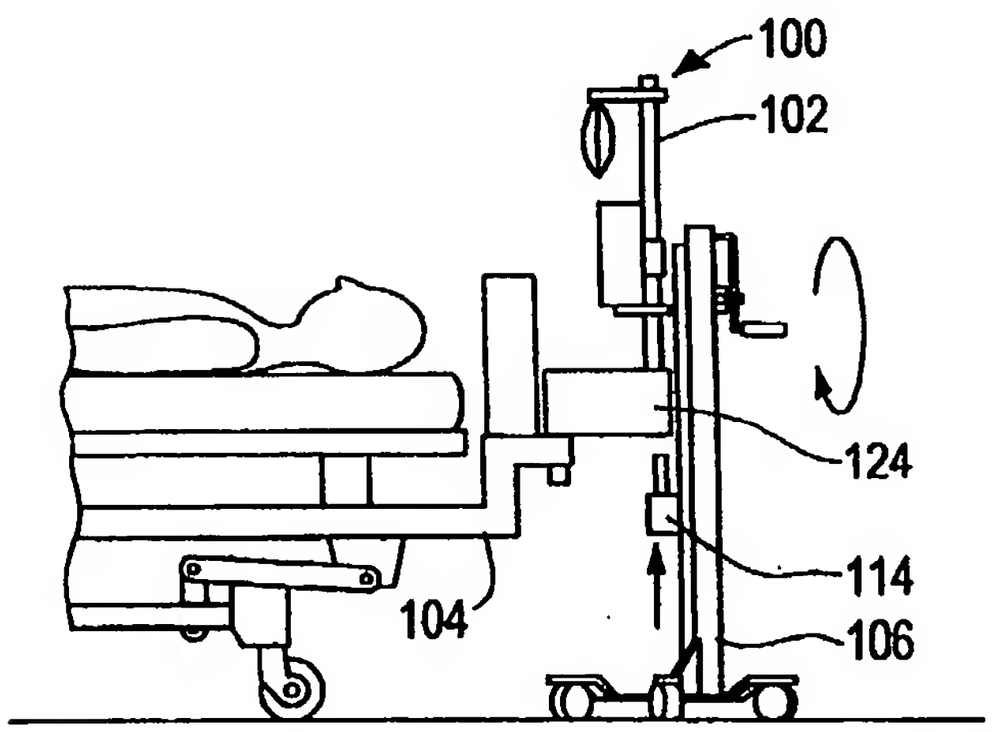


FIG. 18C

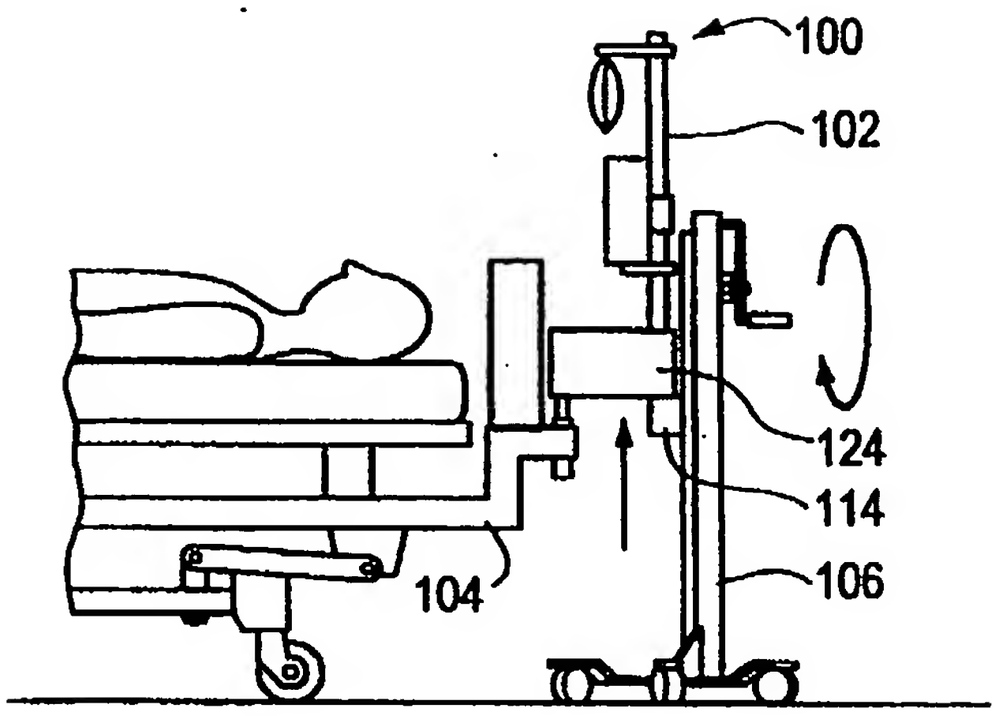


FIG. 18D

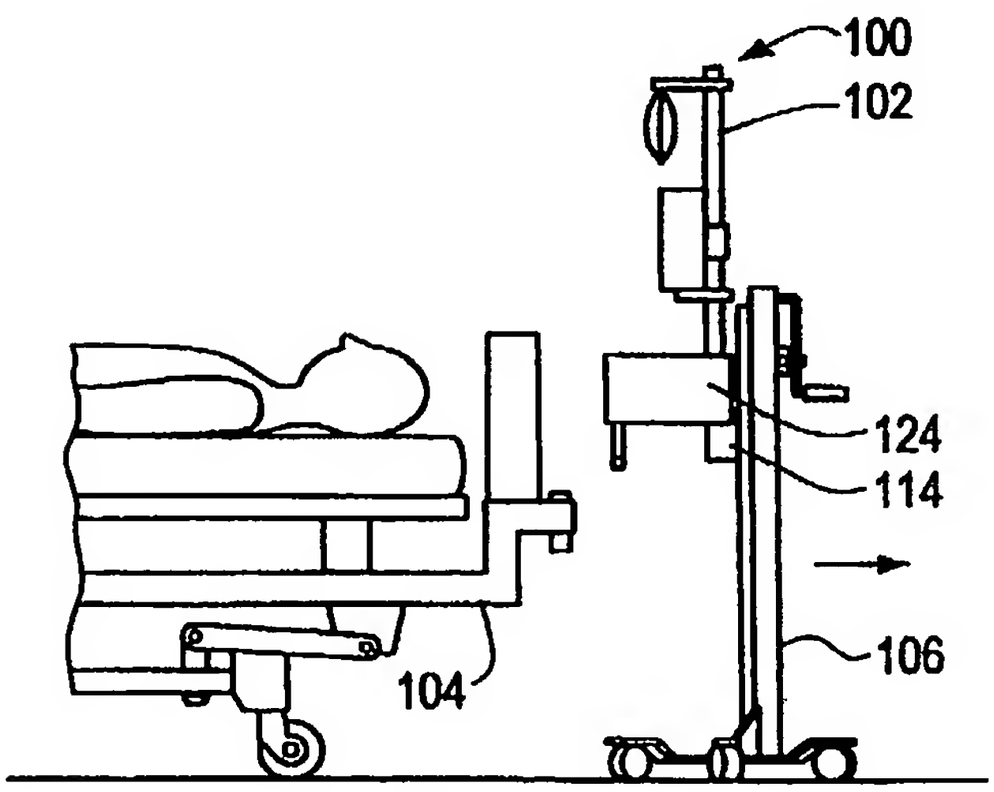


FIG. 18E

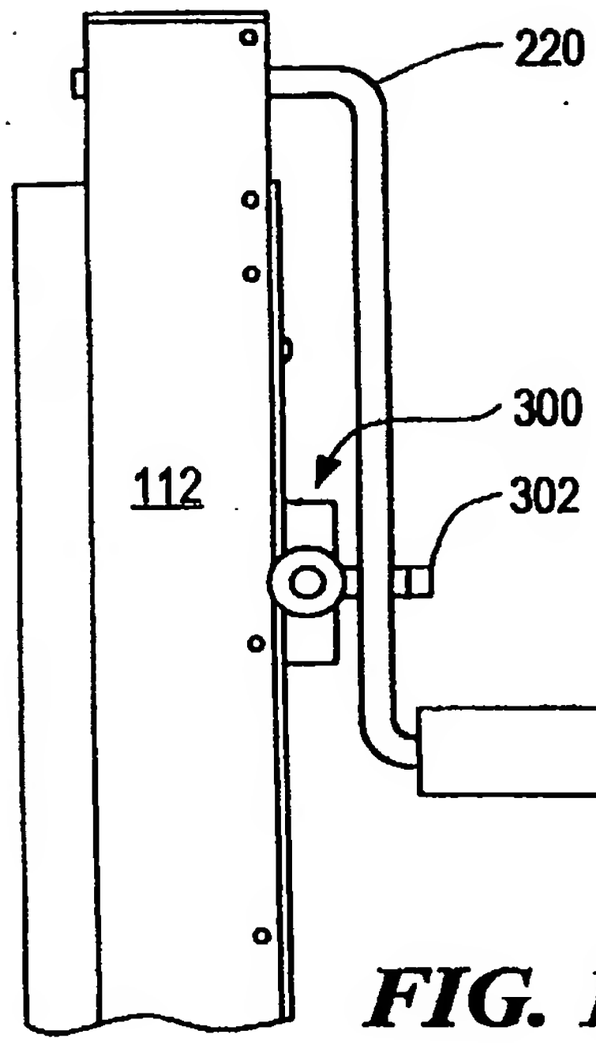


FIG. 19A

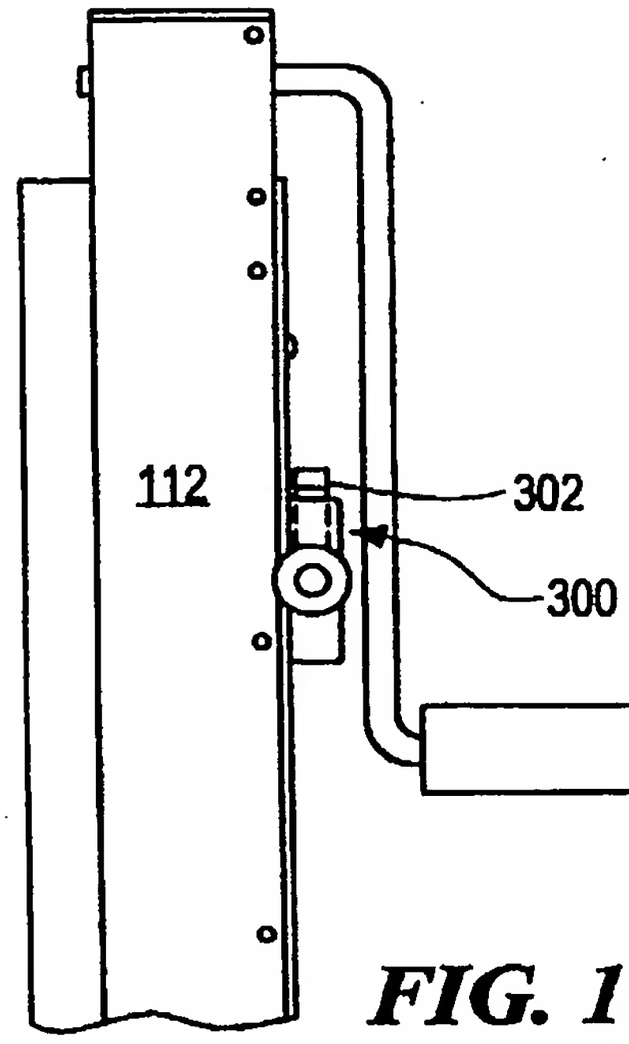
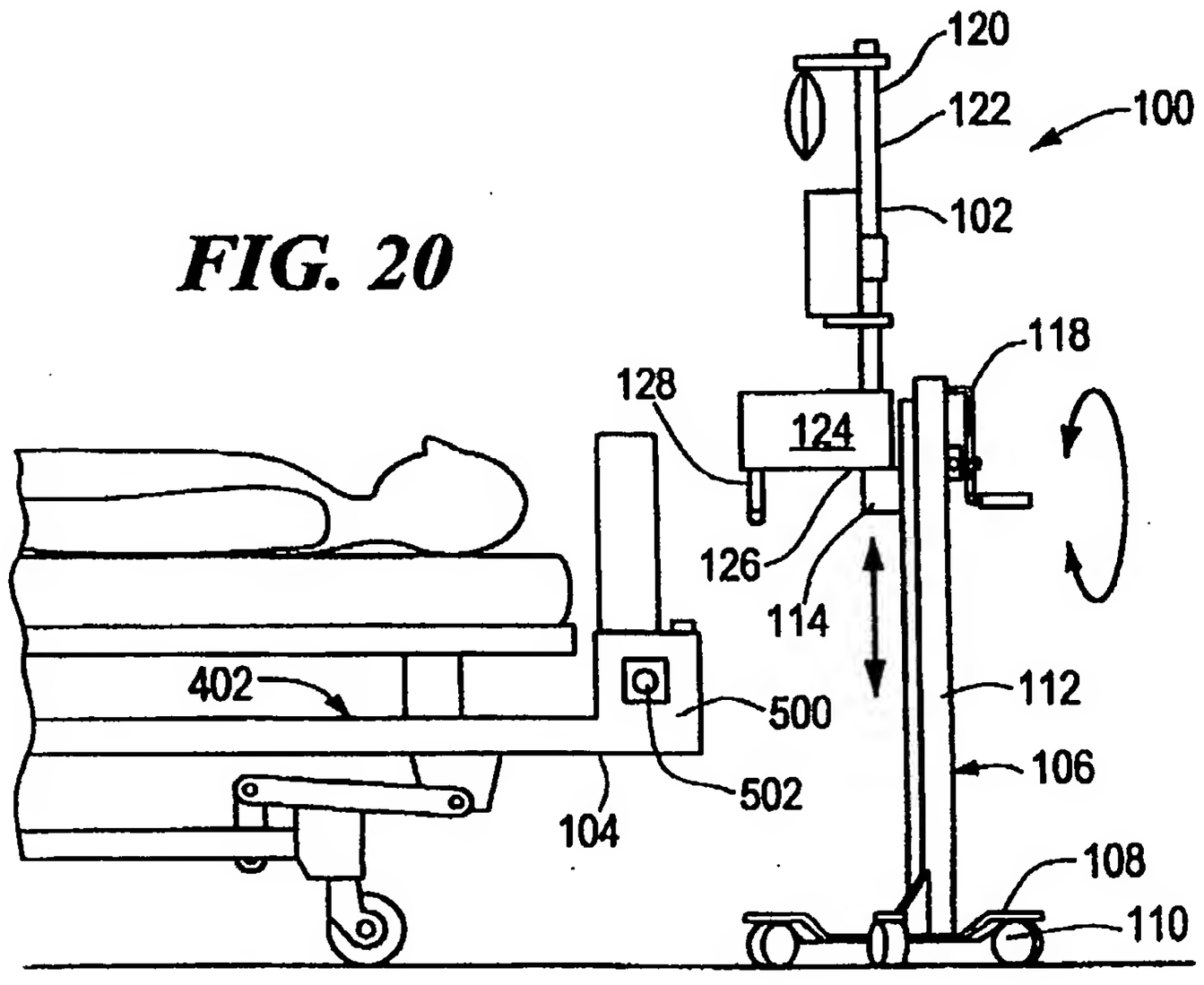


FIG. 19B

FIG. 20



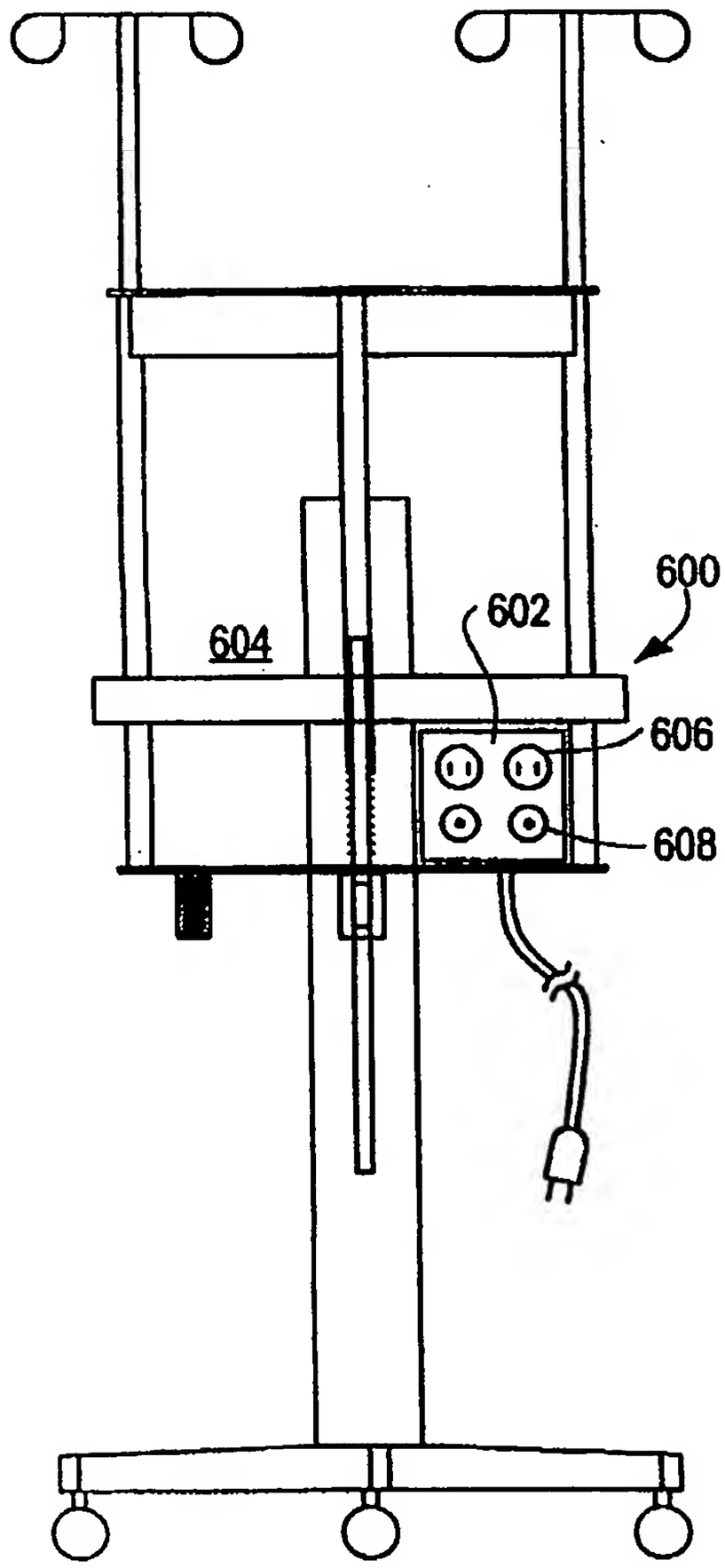


FIG. 21

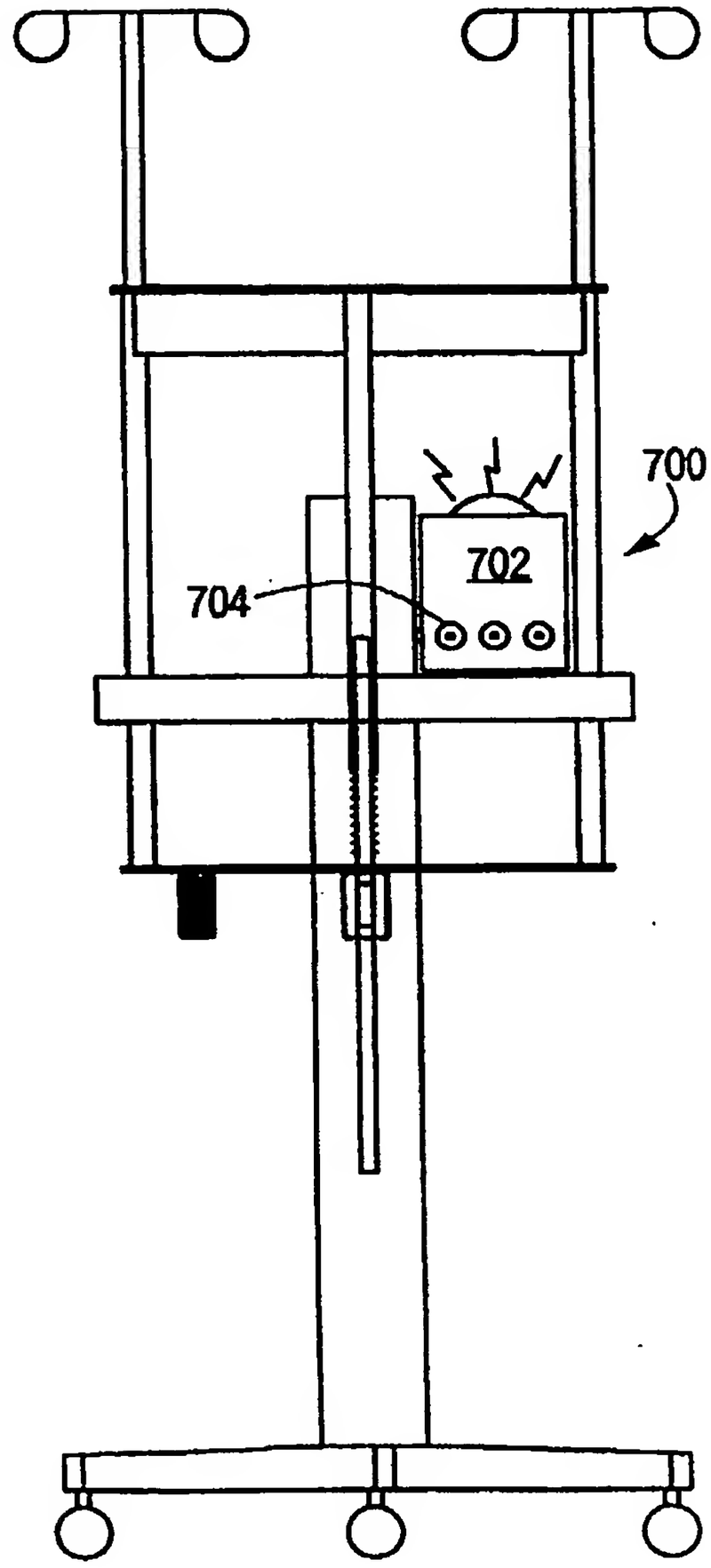


FIG. 22

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/18405

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61G7/05 A61M5/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61G A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 92 18085 A (KREUZER GMBH & CO OHG) 29 October 1992 (1992-10-29) page 4, line 1 - line 27 page 6, line 24 -page 8, line 9; figures 1,5-8C	1,8,15, 24,25
A	US 4 795 122 A (PETRE JOHN H) 3 January 1989 (1989-01-03) cited in the application column 4, line 45 -column 6, line 20; figures	1-7,15, 16
A	DE 41 05 528 A (GUENTHER MICHAEL) 5 December 1991 (1991-12-05) abstract; figures	9
	-/—	

[X] Further documents are listed in the continuation of box C. [X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 December 1999	11/01/2000
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Authorized officer Baert, F

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/18405

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	DE 40 30 368 C (HEITMEIER) 14 November 1991 (1991-11-14) column 2, line 36 - line 55 column 3, line 1 - line 7 column 4, line 23 - line 30 column 5, line 19 - line 51; figures	12,13, 21,22
A	WO 98 25567 A (QUESADA JIMENEZ MARCELINO ;MARTIN SANCHEZ ANGEL (ES); MUNOZ PEREZ) 18 June 1998 (1998-06-18) claims; figures	12
A	US 4 227 269 A (JOHNSTON BRUCE L) 14 October 1980 (1980-10-14) column 7, line 41 - line 66	18,19
A	WO 97 05845 A (HILL ROM CO INC) 20 February 1997 (1997-02-20) page 27, line 3 -page 29, line 14	18,19

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

In ternational Application No
PCT/US 99/18405

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9218085 A	29-10-1992	AT 128347 T	15-10-1995
		CA 2085011 A	24-10-1992
		DE 59203824 D	02-11-1995
		EP 0536368 A	14-04-1993
		FI 925721 A	16-12-1992
		NO 924973 A	22-12-1992
		US 5306109 A	26-04-1994
US 4795122 A	03-01-1989	US 4879798 A	14-11-1989
		US 4901967 A	20-02-1990
DE 4105528 A	05-12-1991	NONE	
DE 4030368 C	14-11-1991	AT 117535 T	15-02-1995
		DE 59104385 D	09-03-1995
		EP 0477551 A	01-04-1992
WO 9825567 A	18-06-1998	ES 1035975 U	01-07-1997
		AU 5189598 A	03-07-1998
		CA 2245786 A	18-06-1998
		EP 0903141 A	24-03-1999
US 4227269 A	14-10-1980	NONE	
WO 9705845 A	20-02-1997	US 5732423 A	31-03-1998
		AU 704613 B	29-04-1999
		AU 6691996 A	05-03-1997
		BR 9609980 A	12-01-1999
		CN 1195977 A	14-10-1998
		EP 0957877 A	24-11-1999
		JP 11500647 T	19-01-1999